

Vol. 1. Page 21 = 170

REMARKS

Upon Two late

Ingenious Discourses:

The One,

An Essay touching the *Gravitation* and *Non-Gravitation* of

FLUID BODIES: *ML*

The Other,

Observations touching the
TORRICELLIAN EXPERIMENT;

So far forth as they may concern
any Passages in his

Enchiridium Metaphysicum.

M. J. Chavignac

By Dr HENRY MORE.

Ἡ φύσις ὅλην μάτην ποιεῖ. Aristot.

L O N D O N,

Printed for *Walter Kettilby* at the Bishops
Head in *S^t Paul's Church-Yard*, 1676.

IMPRIMATUR

Antonius Saunders.

*Ex Edibus
Lamberhanis,
Novemb. 13.
1675.*



THE PREFACE.

Reader,

I Had not given thee the trouble of a Preface, were it not for apologizing for a Phrase which I observe something frequently to occur in my *Remarks*, which may seem to thee hugely Paradoxical, if not very absurd. It is *Gravitation upwards*: I made use of it in imitation of the Learned Authour, upon whose Discourses I make my *Remarks*. Wherefore that thou maist the better discern how allowable or disallowable this form of speech is, and that I may withall offer to thee that which may perhaps tend to the better opening thine understanding in *Hydrostatical Theories*, I will lay down a sim-

The Preface.

ple *Hypothesis* for the illustrating that natural poize, libration or Gravitation that Philosophers suppose they discover in the *Fluid matter* of this our Terrestrial world.

First, therefore, Let us imagine our Earth environed only with the *Materia subtilis*, that *Des Cartes* has so curiously described; or more plainly and intelligibly, with the pure subtil *Æther* which is a liquid body of that subtilty, that it will with ease penetrate all bodies in some measure, but abundantly the pores of Glafs.

Secondly, Let us consider, that as Hail-shot, Gravel, Quick-silver, and the like may be poized in Water, and Corn, Chaff, Currans, Powders, and such like in the Air, and that they will subside or weigh one against another in the said Elements; so the particles of these Elements themselves,
Water

The Preface.

Water and Air, and the vapours therein, are as it were weighed or poized in this more universal *Liquidum* of the *Æther*.

Thirdly, That the particles of Quick-silver, Water, Vapours, Air, and, in brief, what ever is contained in that which they call the *Atmosphere*, if there be no lett nor new emergent mutation, are in this poizing placed according to their *solidity*, chiefly of the very particles they do consist, suppose Air, Water, Quick-silver, according as I have declared in my first *Hydrostatical Axiom*, *Enchirid. Metaphys. cap. 13. sect. 10.*

Fourthly, That in some sense all the parts and particles of the *Atmosphere*, even the thinnest Air at the *convexity* thereof, are heavy, namely thus; That if they were upon some occasion raised higher than the *convexity*, those thin parts of Air would descend again to the said *convexity* as

The Preface.

sure as the vapours do in Dew on the Grass, or raised Dust does upon any pavement or floor.

Fifthly, That this we call *heaviness* is nothing else but a capacity in the parts or particles of the *Atmosphere* to be placed according to their solidity, by that, whatever it is, that moves them, or disposes them.

Sixthly, That when these particles of *Fluids* in the *Atmosphere* are so disposed, with regard to their different solidity, as is according to the Laws of this *moving Principle*, they press not then on one another, but, as to any actual *Gravitation* on one another, they are at rest.

Seventhly, This diversity of solidity in the particles is the cause why we see Elements and liquids in such different *places*, and of such different *Consistencies*. As Quick-silver below water, water below air, the thicker air below the

The Preface.

the thinner, and their *Consistencies* accordingly.

Eighthly, That the more *solid* the particles are in *fluids*, the more strong their *consistency* is, as well as they are thereby more *heavy*.

Ninthly, That as the *moving* or *disposing Principle* brought the several *Liquids* to such various differences of *consistency* by a *positive* action, so it keeps them in the same *consistency* by a like *positive* action or force, though upon occasion mutable or vincible.

Tenthly, That there may be a very strong *consistency* in *Liquids* without any *elasticity* or *springiness* at all, as in *Quick-silver* and *Water* which are not *compressible*.

Elevently, That there may be a *compressible consistency* considerably strong where there is little or no *elasticity* of parts. A thing easily

The Preface.

easily discernible in the wringing or pressing in a mans hand a wet Handkerchief; and of such a *compressible consistency* may be our lower Air, stuffed with thick vapours, as also consisting of the grosser *Aëreal* Particles.

Twelfthly, That all poizings, suspensions or librations of heavy liquid bodies, are not by a mere counterpoize of perpendicular pressure of another body, but may be by the firmness or force of its *consistency*. I speak this in reference to the *Torricellian* experiment, and the standing of the water in Pumps and Syringes, which is thus solved with the greatest ease and intelligibleness that may be, by supposing so strong a *consistency* in this lower Air, that the firmness thereof will resist the weight of suppose 29 inches of Mercury in a Tube, or of 34 foot of water
in

The Preface.

in a Pump, but will be broke by the weight of 30 or 31 inches of Mercury, and 35 or 36 foot of water, and suffer *compression*, to the letting in the subtil *liquidum* or *Æther* (in which the whole Atmosphere is poized) into the Glass or Pump, whereby the Mercury or Water is made capable to descend. And 29 inches of Mercury being of one weight with 34 foot of water in a Tube of the same diameter, it is plain, that this is the poize that equals either the *firmness* of *consistency*, or else the *weight* of the Air.

Thirteenthly, But here now I say lies the curiosity of the Theory, whether this suspension, suppose of the Mercury in the Tube, be to be conceived to be by *perpendicular pressure* or *actual Gravitation* of the Air upon the stagnant Mercury; or else, as I intimated before, by the *firmness* of
of

The Preface.

of its *consistency*, it being not compressible, by no greater weight than that of 29 inches of Mercury, and so there being no *vacuum*, nor penetration of dimensions, the circle of motion is necessarily stopt, and the Mercury stands at that pitch. To which I conceive is most safely answered, That when the Mercury is fallen to 29 inches, that there is a kind of libration betwixt the air jointly with the restagnant Mercury, and the Mercury in the Tube. For upon the infusing of water upon the restagnant Mercury, that in the Tube will proportionably ascend. And this the Learned Authour upon whom I make the *Remarks*, will call *Gravitation upwards*, because its tendency is towards that more subtil matter in the derelicted space in the Glass. And this Libration is not much unlike that in a *Siphon* with one leg much higher

The Preface.

higher than another, into which putting some quick-silver (which will presently poize it self into an equality in each shank) if you pour water into the longer shank, the quick-silver in the other will ascend accordingly: which is again a kind of *Gravitation upwards* against the thin *Air*, and answers to the ascending or gravitating of the *Torricellian* Mercury in the Tube against the subtil *Æther* there. But that the parts thus librated in this *liquidum subtilissimum*, (in which the whole Atmosphere is poized by the moving or disposing Principle) when they are settled in their poize, press or gravitate one upon another, I do utterly deny. But then secondly, I say, the *firmitude* of the *consistence* of the Air is as it were the *string* of this *balance*, which if it break, or so far forth as it breaks or relaxates, the Mercury in the Tube will fall down.

The Preface.

down. And thirdly, that the Mercury is kept up by this *string* of *firmness* of the *consistency* of the Air, and not by the actual *gravitation* of an *Atmospherical* Cylinder of an equal diameter on the restagnant Mercury, appears from that experiment of the Mercury in the Tube not falling, though the Vessel of Mercury be close covered in a Glass, and so the supposed pressure of the *Atmospherical* Cylinder intercepted, and a commodious Valve made, that upon the falling of the Mercury would let the Air out, though there be none let in by it; which Valve the weight, suppose, of ten pounds of Mercury would be sure to fling open, if it were the weight of the *Atmospherical* Cylinder that held up that ten pound of Mercury in the Tube before. Nor fourthly, can it be the spring of that Air included in the Glass that upholds

The Preface.

holds the Mercury in the Tube, since it must be so great, that it must hold up no less than the weight of ten pound of Mercury; and if the *elasticity* of the Air be so great or strong, considering the subtilty of the parts of the Air that make this spring, which are hugely more subtil and thin, and consequently more cutting than the edge of a Razor, it is impossible but that they should cut with all imaginable ease into the Quick-silver, and so piercing into it prove unserviceable for the pretty feat they are intended. To say nothing here of the excellent arguments of this Learned Authour upon whom I remark, by which he seems to me quite to have defeated that modern Paradox of the monstrous *elasticity* of the Air, which yet some eximious Wits have so favourably entertained.

Where-

The Preface.

Wherefore lastly, to detain my Reader no longer in a less needful Preface, From what has been said he may easily discern, that this Phrase of *Gravitation upward* is not destitute of all good ground, since such libration upward terminates on a thinner Element, as true and proper Gravitation always does; and he may in the mean time observe there is no proper Gravitation but in such cases, when a heavier fluid sways upon a lighter, but that the parts of the heavy fluid do not press or gravitate one upon another at all, nor a lighter upon an heavier, but are moved jointly by that *Principle* which disposes them according as we have above described; and finally consider with himself, whether it be not more likely there should be such a *subtil Element* penetrating all Bodies, in which they, or (to speak more compendiously)

The Preface.

diously) the whole *Atmosphere* is librated, and that there is likewise that vincible *consistency* of the lower Air, than that there should be that *Tension* this Learned Authour stands up for (which cannot be without penetration of dimensions, nor is it conceivable how such an extended *Funiculus* should hold together) or (which this Authour is as much against as for the other) that there should be such a monstrous *elastick* pressure of the Air, and *actual gravitation* of the parts of the *same elements* one upon another, when the Particles are of the same solidity; Which as it is against more solid and searching Reason, that enquires after the *final cause* of things, and duely relishes that excellent Aphorism of *Aristotle*, *Natura nihil agit frustra*: So is it manifestly against common *sense* and *experience*. Methinks the Hypothesis I have here briefly
a described,

The Preface.

described, is far less obnoxious than any of the other. But if any one be otherwise minded, I know right well, that liberty of philosophizing is the common right of all that in good earnest profess themselves free Philosophers.

On

The Contents.

On the Essay touching the Gravitation and Non-Gravitation of Fluid bodies.

REMARK the First.

OF Gravity and Gravitation,
*that it is nothing but Mo-
bility and Actual Motion, and up-
on what terms it is fit to conclude
actual motion to be in a body.*

REMARK the Second.

*Whether Motion downwards
belong to solid bodies as such, and
whether some fluids have not a
stronger tending of that kind than
some solid bodies.*

The Contents.

REMARK the Third.

The true reason why the parts of solid bodies do not gravitate one upon another.

Upon Chapter the Fourth.

THE attempt of supplanting my demonstration in Enchirid. Metaphys. Cap. 13. Sect. 4. by introducing a Cap or Cone of water only gravitating on the Lamina lignea, succinctly explained.

REMARK the Fourth.

The disparity betwixt the Cap or Cone, and Cylinder of Water and the Pyramid of Bricks.

REMARK the Fifth.

That the former instance of Masonry in the Pyramid of Bricks, will

The Contents.

*will not so much as hold in Wheat,
Sand, and Hail-shot.*

REMARK the Sixth.

*The suspended Sand in the top
of the body of a Cylinder no ar-
gument for any such supposed Ma-
sonry in the element of water.*

REMARK the Seventh.

*The Mechanical Incumbency of
the particles of Sand on the Egg-
shell in the manner of an Arch,
whence to be enervated.*

REMARK the Eighth.

*Of the lateral Direction of the
parts of Sand and such like bo-
dies.*

REMARK the Ninth.

*Four Arguments to show the in-
a 3 validity*

The Contents.

validity of this pretended Masonry in water against my demonstration from the round Lamina lignea in my Enchiridium Metaphysicum.

REMARK the Tenth.

The intrinsical Gravity of water how to be understood.

REMARK the Eleventh.

That water in its fluid consistency gravitates, and in what sense it so does, infused on Quick-silver, into which a Tube is immitted, &c.

REMARK the Twelfth.

That a Bucket of Water is not as much one continued body as a Bucket of Pitch, and wherein the nature of Fluidity does consist, and how eminent in water.

The Contents.

REMARK the Thirteenth.

The Learned Anthour's mistake touching the Principium Hylarchicum, with a brief description thereof.

REMARK the Fourteenth.

The distinction of considering water as a solid body and a fluid body examined.

REMARK the Fifteenth.

A twofold Mechanical account of the Non-Gravitation of the particles of water on subjected bodies, viz. from the Continuity of the particles, and from their Architecture or Masonry, with a confutation of both.

The Contents.

REMARK the Sixteenth.

That the Learned Authour himself at last admits, that the parts of water are not continuous but contiguous. His refuge to the Masonry of the particles also confuted.

REMARK the Seventeenth.

Whether the Cartesian aqueous particles be more fit for this supposed Masonry, than those of Wheat, Hail-shot, and Sand.

REMARK the Eighteenth.

Whether water be quid continuum or contiguum.

REMARK the Nineteenth.

A Column of water gravitating on a Rundle upon a perforated bottom

The Contents.

bottom of a Bucket, how reconcilable with this supposed Masonry of the Arch.

REMARK the Twentieth.

An experiment of two Rundles urged against this supposed Architecture, together with an experiment that clearly takes away both his Mechanical accounts at once, that of Continuity and this of Masonry.

Upon Chapter the Eighth.

T*hat the Authour lays his main stress on his natural account of the Non-Gravitation of water, &c.*

REMARK the Twenty first.

Intrinsical Heaviness of a body, how ex pacto to be understood from my first Remark.

R E.

The Contents.

REMARK the Twenty second.

The Authour's description of his Natural Account of the Non-Gravitation of Fluids, &c.

REMARK the Twenty third.

The Authour's distinction of the terminal motions of water as a heavy body and as of a fluid body examined by our Agreement in the first Remark, and concluded, That all the directions of Motion in water as to Primitiveness and Intrinsecalness are of one kind.

REMARK the Twenty fourth.

That the Learned Authour has abundantly well proved the various tendencies and pressures of water every way, but not every way at once or the same time.

RE-

The Contents.

REMARK the Twenty fifth.

The usefulness of the conjunction of primitive Gravitation with the motion of water downwards, as to the Authour's scope; this primitive Gravitation of the aqueous particles remaining, as if it were alone, the motion of water upwards defeating that downwards; and primitive Gravitation taken away making a Bucket of Air and Bucket of water æquipoherent. So that either way this natural account is subverted.

REMARK the Twenty sixth.

That the various lines of direction of motion, beside the perpendicular, can contribute nothing to the abating of the intrinsic Gravitation.

RE-

The Contents.

REMARK the Twenty seventh.

That the imagined continuity in water more than in Callis-sand, nor the motion per declive, can abate the Intrinsick Gravitation of water if there were any in it.

REMARK the Twenty eighth.

That the tumbling of the Callis-sand per declive, does not prove, that when the granules rest, they press per declive but downwards.

REMARK the Twenty ninth.

How from the supposition of just 12 l. stock of intrinsick weight in a Cubick foot of water to be dispensed to all the various lines of motion in water, and yet there being felt just 12 l. weight still, it is demonstrable, that all the other motions are merely imaginary not real.

RE-

The Contents.

REMARK the Thirtieth.

The ineffectual Answer of the Author to this difficulty; with a further Confutation of this natural Account of his from a Bucket of Ice.

Upon *Difficiles Nugæ*, or Observations touching the Torricellian Experiment.

THE Transition from his Remarks upon the Essay touching the Gravitation of Fluids to this other touching the Torricellian Experiment.

REMARK the First.

of Rarefaction and Tension,
and of Condensation and Resti-
tution

The Contents.

tution in the Authour's sense. The groundlessness of them proved, by proving there are subtiler particles in the Air than those that are properly Aëreal. As also their repugnancy to reason & experience.

REMARK the Second.

The distinction of Gravitatio ad motum, and Gravitatio ad pondus. And that it is unconceivable, how the latter should be without the former; if there be any intrinsic Gravity in heavy bodies so called, together with the true reason why the parts of lead do not gravitate one upon another.

REMARK the Third.

*That the increase of Renitence or Pressure of the water against its being raised higher in B, more than in A, and in C, more than in B, is not the reason that the Oil in
the*

The Contents.

the Tube does not go out at B, and ascends at C. Also why a Pewter Porringer full of Hail-shot weighs alike in water from the bottom to the top.

REMARK the Fourth.

Smaller particles in the Air acknowledged by the Authour himself, together with a disproofment of his supposed continuity of the greater.

REMARK the Fifth.

Compressed Air appearing heavier no proof that it had innate Gravity in it before, but rather that there is no such thing as intrinsic Gravity in the world.

REMARK the Sixth.

The Cohæſion of the parts of water weaker than that of Air, according

The Contents.

according to the Authour, a manifest Argument against his pretended Masonry in the parts of water.

REMARK the Seventh.

His experiment of the Glass-Siphon with Quick-silver and Water, and his mistaken conclusions therefrom: And what excellent use there may be made of it against his imaginary Architecture in the element of water.

REMARK the Eighth.

His invention of the Cap or Cone enervated from Stevinus his experiment of a Rundle on the bottom of a Vessel with an hole in it.

REMARK the Ninth.

*The Gravitation of the water in that case on the Rundle whence it is, whether simply because of
the*

The Contents.

*the Air underneath, or because the Air is in the state of Abiturien-
cy. Where something by the by of
the Spirit of Nature.*

REMARK the Tenth.

*Why an empty Glass-bottle care-
fully stopt and sunk into the Sea
is broken, and why in some cases
Oil drives Water, and Water
Quick-silver upwards, and what
shroud insinuations such Phæno-
mena are, that there is no such
thing as inward Gravitation in
bodies, but that mater is ranged
according to the Laws of the Spirit
of Nature,*

REMARK the Eleventh.

*That the reason why a small
Glass-Tube filled up with water,
and immitted into a Vessel of wa-
ter, the water in the Tube will sink
till it be even with the superficies
b of*

The Contents.

of the water in the Vessel, is not from the force of the water in the Tube to press downwards, but from some higher Principle.

REMARK the Twelfth.

The pretended obscure solution in Enchirid. Metaphys. cap. 13. or reason of the falling off, and sticking to of the Obturaculum in a Tube with a Valve, according as the Tube is more or less immersed in the water, more fully explicated.

REMARK the Thirteenth.

That the sticking of the Obturaculum to the Valve, is not simply from the Tubes pressing up a portion of water of a greater weight than it, because if the Abituriency of the air in the Tube be in a due measure sufflaminated, the Obturaculum at the same depth

The Contents.

depth will fall. Together with a farther confutation of this reason from Glass-bottles well stopt and immitted into the Sea. Whence the operation of the Principium Hylarchicum is farther discovered

REMARK the Fourteenth.

A notable Experiment of the Authour's in a Tube of Quick-silver, which if he had rightly improved, might easily have led him to an acquaintance with the Hyllostatick Spirit of the world.

REMARK the Fifteenth.

Two more Experiments out of Honoratus Faber, a farther confirming of our solution of the former.

REMARK the Sixteenth.

The Authour's mistake in making
b 2

The Contents.

ing all bodily motion to be wrought by the contact of some active body, whenas most bodily motions in the world are not Mechanical but Vital.

REMARK the Seventeenth.

The Authour's mistake conceiving that there are no pores in Glass, and that if the Æther pass those pores it must pass freely.

REMARK the Eighteenth.

His mistake further discovered from his own Experiments and Observations made in a Glass-Tube of Mercury inverted in the Air, and the Mercury in the Torricellian Experiment.

REMARK the Nineteenth.

And further still detected by demonstrating the incredibility of the

The Contents.

*the ascending of any vapours or
streams from the Mercury into the
derelict space in the Tube.*

REMARK the Twentieth.

*A notable Objection of the Au-
thour's against the Opinion of
Mercurial effluvia occupying the
derelict space of the Tube, and
such as himself does not answer.*

REMARK the Twenty first.

*A sound and ingenious demon-
stration of the Authour's against
the Hypothesis of an Atmospheri-
cal Cylinder suspending the Cy-
linder of Mercury in the Tube,
from the Tube of Mercury hung up-
on a Balance, with its mouth some
half an inch immersed in restag-
nant Mercury.*

The Contents.

REMARK the Twenty second.

His ingenious obviating that evasion of a Cylinder of Air pressing on the top of the Tube of Mercury so hung, as if that supplied the place of the Mercury in the Tube, whose weight was discovered in the opposite Scale of the Balance.

REMARK the Twenty third.

His dextrous defeating as weak a subterfuge, whereby they would elude the force of his former Answer.

REMARK the Twenty fourth.

Two neat Experiments of the Author's, whereby he meets with all such elusions, and unexceptionably demonstrates, that the pressure of an Atmospherical Pillar in such like Hydrostatical Experiments is a mere mistake. R E.

The Contents.

REMARK the Twenty fifth.

Another ingenious demonstration against the pressure of Atmospheric Cylinders from the standing of the Mercury in the Tube, when the surface of the restagnant Mercury is not passing one fourth part of the Basis of the Cylinder of Mercury in the Tube.

REMARK the Twenty sixth.

His Argument from the Torricellian Experiment succeeding as well in a closed Receiver as in the open Air not imputable to the elasticity of the Air which supposes pressure; it being already confuted here, and more particularly in his sixth Chapter by the two Brazen Cylinders in the water.

The Contents.

REMARK the Twenty seventh.

His Experiment of the Bottle and heated Bolts-head, how well it is levelled against the elasticity of the Air, but his solution of the Phænomenon unsatisfactory.

REMARK the Twenty eighth.

The Authour's Opinion that all those Experiments which the Virtuosi would give an account of from the pressure and elasticity of the Air, are performed by suction and attraction, more strictly to be examined, in reference to that Experiment of the weight hung at the Embolus of the Air-Pump.

REMARK the Twenty ninth.

The various standing of the Mercury in the Tube, according to the change of weather, or placing it
it

The Contents.

it in higher or lower Air; how that Observation is manageable against the opinion of Tension and Mercurial effluvia.

REMARK the Thirtieth.

The unexpected motions and agitations of things (put into the Receiver) upon a strong exhaustion of the Air-Pump, that it is not from Tension of the rarefied Air, but from some such Principle as the furious and rapid motion of winds is, raised from the dissolution of the aqueous particles of the clouds.

REMARK the Thirty first.

*That Experiment of Regius, of drawing Tobacco smoak through water in a covered Cup, by two pieces of a Tobacco-pipe, can be no instance of such an Attraction and Rarefaction as this Author stands for, but will serve to illustrate
some*

The Contents.

Some of the Phænomena in the foregoing Remark.

REMARK the Thirty second.

A description of the Torricellian Experiment in the chiefest example. The groundlessness of the Author's reasons of this Phænomenon from the tension of the Mercurial effluvia in the derelicted space, discovered.

REMARK the Thirty third.

A discovery of the Repugnancies of his solution of this Phænomenon. His ingenuous confession touching the Phænomenon of Gravity, that mechanical reasons are in vain attempted thereof. That Aristotle's Philosophy implies a Spirit of Nature.

R E.

The Contents.

REMARK the Thirty fourth.

That the suspension of the Mercury is not to save the Universe from Discontinuity, but to preserve the Air in its due consistency. And that it is not Air but one common Spirit that is the Cement of the Universe.

REMARK the Thirty fifth.

That Attraction is not to be proved from Cupping-Glasses, or the expansion of squeezed Bladders at the top of the Torricellian Tube.

REMARK the Thirty sixth.

What account is to be given of the jointly weighing of a Tube and Mercury, of a Tube and Water, and of a Glass and Water inverted on Mercury and Water.

RE-

The Contents.

REMARK the Thirty seventh.

The Authour's plain declaration, that the Laws of Nature are not mechanical, together with the consequences of that concession, and the necessity of introducing a Spirit of Nature. The fond humour of the Philosophizers of this Age, who whenas their Nature consists of Spirit as well as Body, take all their measures of Philosophizing from Body, none from Spirit.

REMARK the Thirty eighth.

Of the sticking together of two Marbles; and that Fuga Vacui is but the final cause thereof: and what may be the Efficient.

REMARK the Thirty ninth.

*Stevinus his Experiment of a
Rundle*

The Contents.

Bundle of wood lighter than water laid upon the hole of a bottom of a Vessel to be filled with water, &c. What an Argument it is against the Gravitation of water on water, and against that monstrous Elasticity (by some supposed) of the Air.

REMARK the Fortieth.

Of the close sticking together of the Magdeburg Hemispheres. That neither Tension of the inward rarefied matter, nor the Elasticity of the outward Air is the cause of it, as also what in all likelihood is.

REMARK the Forty first.

*The Authour's ingeniously contrived Pump, and his mistake in attributing a Phænomenon in it to inward Tension, which is rather to be referred to the strength
of*

The Contents.

of the Consistency of the outward Air,

REMARK the Forty second.

Other Phenomena observable in the Authour's Pump, and how there is no need of Tension for the solving of them, but that they are notable intimations of the necessity of an Hylostatick Spirit in the world.

REMARK the Forty third.

An Argument from the Author's own Pump, that water is not suspended in Pumps by Tension, but by Gravitation upwards, more expressly here explained, and at last resolved into the Hylarchick Principle, together with a particular reason why in the proposed case of the Authour's Pump, upon the elevation of the Embolus, not one drop of water comes out.

R E-

The Contents.

REMARK the Forty fourth.

The uncertainty of success, if the Pump were longer, or heat applied to the Glass; but certain, Tension would find no place therein.

REMARK the Forty fifth.

The raising water and suspension of it in a Pump how it is effected.

REMARK the Forty sixth.

The insinuation of the Air into the Cavity of a Well, whether it be the effect or the cause of the recession of the water, or whether not rather both.

REMARK the Forty seventh.

*Whether the protrusive force in a Pillar of free Air add any thing
to*

The Contents.

to the Elastick pressure thereof, and whether the least proportion of Air has the same strength of spring that a greater. As also a notable Argument from the elasticity of Air not raising the water in the Authour's Pump one inch, when- as it is pretended, that it will sustain 10 l. of Mercury 29 inches high; that there is no such Elasticity at all.

The Conclusion.

Errata sic corrige.

PAge 9. line 21. read bodies. p. 37. l. 17. r. intrinsicallness. p. 107. l. 21. r. Tube. p. 146. l. 6. r. ordered. p. 177. l. 1. r. considerate.

I
Remarks upon two late ingenious Discourses,

THE ONE

An *Essay* touching the *Gravitation* and *Non-Gravitation* of *Fluid Bodies*,

THE OTHER

Observations touching the *Torricellian* Experiment.

On the *Essay* touching the *Gravitation* or *Non-Gravitation* of *Fluid Bodies*, &c.

Upon Chapter the Second.

The first REMARK.

IN this Chapter there are things said that are repugnant one to another. For in the very entrance of the Chapter the learned Author asserts that *Gravi-*

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ty

ty is an *intrinsic* quality of bodies whereby they tend Downwards to or towards the Center of the Earth; and yet afterwards toward the end of the Chapter, he affirms that fire may rightly be said to gravitate Upwards, &c. Now if that Definition be true, That *Gravity* is an *intrinsic* quality of bodies whereby they tend towards the center of the Earth; whether by *Gravity* be understood a faculty or capacity of so tending, or the actual exercise thereof, we cannot avoid a repugnancy. For if an actual exercise thereof be understood, that is *Gravitation*: Which here being affirmed to be the tending downwards of bodies towards the center of the Earth, it is a contradiction that the tendency of them upwards should be *Gravitation*, but rather *Levitation*. But if by *Gravity* be understood only their *Capacity* of tending down-

downwards to the center, yet the actuality thereof will be *Gravitation*, as that of *Levity*, *Levitation*; and therefore according to this Notion of *Gravity*, can be only downwards, when as the learned Author after asserts that *Gravitation* is also upwards, which, I say, seems a contradiction. But I rather interpret it an emendation of his former assertion, and by after affirming that *Gravitation* is upwards as well as downwards, that he would insinuate, that it is really and in truth, (against that sense that *Gravity* and *Gravitation* is understood in the Schools) as well upwards, transverse, oblique as downwards, there being no way such *Gravity* or *Gravitation* as the Schools dream of, that is, from any inherent quality of the body it self, that may be called *Gravity*, but that it is a mere *Idolum Fori*, as My Lord *Vernulam* would

call it, a false Notion sticking to the vulgar use and sense of that word, which me thinks this learned Author does apertly acknowledge, and consequently explode that usual Notion, in these words where he says; That *Gravitation* is nothing else but *Motus*, or *Nisus ad motum secundum lineam directionis ejusdem*; and a little before, That *Gravitation* is nothing else but *motion*, or at least *Conatus* or *Nisus ad motum*: Which in my judgment plainly takes away that false notion of *Gravity* and *Gravitation*, entertained by the Vulgar and the Schools. For it as plainly follows, by denying all *intrinsecal* nature to *Gravitation* saving *motus* or *nisus ad motum*, that that Scholastick *Gravitation*, or the specifick nature thereof is taken away, as by denying that *Homo* is any thing but *Animal vitâ sensûq; præditum*, would take away the specifick nature

nature of man out of the Universe.

The first part therefore of this my first Remark shall be, That, even according to the judgment of this learned Author, there is nothing in bodies but *mobility* and *actual motus* or *Nisus ad motum*, however they may be disguised under the vulgar Phrases of *Gravity* and *levity*, of *Gravitation* or *levitation*, &c.

Secondly, That the Author, though in proceſſe of his discourse he use these vulgar Phrases of *Gravity* and *Gravitation*, he is to remember that the true and Philosophical sense of them is nothing else but *Mobility*, and *actual motion*, or *actual Nisus ad motum*; which if it be considered in its direction towards the Center of the Earth, is more specially noted with the name of *Gravity* or *Gravitation*.

Thirdly, That if we will cau-

tiously and severely Philosophise, we are not to imagine this *actual motion* or actual *Nisus ad motum* to be in any body, unless it be discovered there to be, by clear sense or reason; but rather not to be when we have diligently used these two faculties for to discover them, and yet they appear not.

4. Fourthly, It is deprehensible neither by sense nor reason, that because water, for example, will nimbly run up a Tube let down into water, stopt with ones finger at the neather orifice, and then opened, that there was before any actual motion upwards in the water, or any actual *Nisus ad istiusmodi motum*, but that as to any such motion, it was at rest.

5. Fifthly, That if the quick running up of the water into such a Tube be a solid argument of an actual *Nisus* of the water upwards,

wards, even then when it has no such occasion to discover it self, the quickness of the ascent of the water is so great, and so equal to the descent of water in a crooked Tube of water opened at one end in the Air, after it is immersed into the water, I mean the other orifice stopt also with ones finger and then opened again when it is let down at a sufficient depth, that the actual *Nisus* of the water, (suspended, suppose in a Bucket) downwards and upwards will be in a manner equal. So that the water will have no weight at all; in so much that another Bucket of the same weight and size, without any water in it, would be equiponderant to it.

From whence Sixthly and Lastly 6.
it would follow, That we finding
so great a weight from the water
in the full Bucket, with an
actual *Nisus* downwards, there
B 4 must

must be a Being distinct from the water, that directs its motion thitherward. But this is an Observation beyond my present scope. The rest, at least, will be useful for the better understanding our selves in our following Remarks.

Upon Chapter the Third.

The second REMARK.

IN the beginning of this Chapter the Author seems to affirm that it belongs to *solid* bodies as such to have an actual pressure, or *Conatus ad Motum* towards the Center of the Earth, but to *fluids* onely as they are reducible to *solids* by being put into some Vessel; when as yet it is evident that some *fluid* bodies have a stronger pressure towards the Center of the Earth than many *solid* bodies. Thus bulk
for

for bulk water presses more strongly towards the Center than most kinds of Wood, and Quick-silver than most kind of metals. Whence it is plain that *Gravity* is not to be esteemed from the *fixedness* of parts, but from the *solidity* of the particles, which that Principle that orders matter ranges accordingly.

REMARK the Third.

That also I conceive is a mistake, in that he says, *p. 15. l. 3.* That though solid bodies do actually gravitate, yet the parts thereof do not gravitate one upon another because mutually and *mechanically* sustained one by another, and in a state of *continuity*. For first, the *continuity* and *fixedness* of solid bodies in Nature is not *Mechanical* but *per σύμπεσιν*. And then that the parts do not gravitate one upon another is
not

not from their *continuity*, but *Homogeneity* or equal solidity of particles rather. Whence it is, that in *fluids* of an *homogeneous* Nature, the parts do not gravitate one on another; but in *solid* bodies and continued, if one side be *pumiceous* suppose and the other *metalline*, the *metalline* will gravitate on the *pumiceous* or *spungie* side.

Upon Chapter the Fourth.

IN this Chapter and in the eight are laid down the two main Principles, which seem to be intended against the force of my Demonstration in my *Enchiridion Metaphysicum*, in which I so much exult, *Cap. 13. Sect. 4.* Both which therefore I shall more carefully examine. The Principle in this Chapter aimed at is: That in liquid bodies, suppose in water, that a whole *Column* of water

ter from the subjected body to the surface of the water does not gravitate, but only a *Cap* or *Cone* of it, at a little distance from the subjected body. Whence it might seem hopeful, That my *Lamina lignea* in a bucket, being pressed upon but by such a low *Cone*, and that the rest of the weight of the water discharging it self betwixt the sides of the Bucket and the *lamina*, might well raise it up, &c. But that this is only a witty phancy, I hope I shall make appear from these following Remarks.

REMARK *the Fourth.*

That the Residue of the Pyramis (p. 23. l. 13.) would stand without any gravitation upon the Cavity left by the subsiding of those sixteen stones and those that are meerly supported on them can be no argument,

gument, that only a *Cone* or *Cap* of water gravitates on the round *Lamina lignea*, both because the *Lamina lignea* does not subside from the rest of the column of water above it, but bears against it, and also because if it should be imagined a little to subside, the particles of water being flexible would still lean toward the subsiding Cone, and being so infinitely small would certainly tumble after it if the Cone subsided to any distance. So unfit is this comparison, though in other respects sufficiently ingenious.

R E M A R K *the Fifth.*

And whereas this Learned Author saies, (*p. 24. l. 8.*) That this Instance of *Masonry* which he has given in square Stones, will hold in smaller and more irregular bodies, Experience will prove they

they will not in those he instances in, Wheat, Sand, and Hail-shot. For if there were an Hole made at the bottom, that that Cap, he imagines, might really subside and be taken away, the expected Arches in each experiment would prove ill built by their sudden tumbling to the ground. Nor would the Egg-shell and its little Cap or Cone of Wheat stand as under an Arch supported by the rest of the Grains in the whole heap, as he affirms p. 26. l. 6. And therefore that the Egg-shell scapes so well is to be referred to some other cause. As for that lateral pressure *per declivē* which may refract the perpendicular Gravitation of the grains of Wheat, I shall examine that conceit in its * due place.

* Remark
8. 28.

REMARK the Sixth.

That the Sand remained suspended

spended in the body of the Cylinder, is to be attributed to the weight of Lead that had crammed the Sand together, that especially toward the top, next to which it was, that it stuck by renitence of its irregular parts, one against another, *p. 27. l. penult.* But what is this to the nature of water, where all is so infinitely glib and passable, one particle by another, not the least show of stuffing and cramming? A man might make a pair of Pinfers that set into a bed of Sand, (though the Pinfers be open above and beneath and Tube-like) which would pull up more sand than stuck in this Tube. And it is all one whether the Sand be pinched by such Pinfers or be pinched by cramming into such a Tube. That's all the Mystery of *Masonry* that I can discern in this experiment.

RE-

REMARK *the Seventh.*

But that there was not any such Mechanical Incumbency of the particles of the Sand as left the Egg-shell as it were under an Arch, so that from thence it was that only a small *Cap* or *Cone* of Sand gravitated upon it, seems to me to be manifest, in that if there were an hole made of the same diameter with the Egg-shell, and the Egg-shell taken away, not only the Cap of Sand but the Arch would come tumbling down to the ground, and therefore that the Egg-shell is not damnified must proceed from some other cause. The Sand about the sides apparently protects it from the weight of the Lead.

REMARK *the Eighth.*

That the lateral direction in
the

the parts of Sand or such like bodies, p. 29. l. 3. should refract the perpendicular *Gravitation*, when as it self is but a *lateral Gravitation* or an hindred *perpendicular* direction, in a Tube suppose or Vessel, may justly be questioned. For the Particles once checked by the sides of the Tube or Vessel, in all likelihood spend then all their direction downward, or may be reflected more dangerously from the sides to the hazard of the Egg-shell: If the reason of things lay this way.

REMARK the Ninth.

- I. That the *Non-Gravitation* of the small bodies, p. 31. l. 3. of Sand, Gravel and Shot, do not sufficiently prepare our minds to apprehend one of the Reasons of *Non-Gravitation* of *Fluids*, is manifest from that so often inculcated instance of the tumbling down

down of the Arch at the real removal of the Cone or Cap with the body subjected, and an hole made of equal bigness on an upper flore or table.

Besides, though in such gross particles as Sand, and Wheat, and Shot, one part may help a little to sustain another: yet as in a Tube of *Physical Monads*, if they were imagined heavy, this would not at all be; so in water whose parts are so infinitely little in comparison of Shot, Wheat, or Sand, this *Masonry* of parts leaning upon parts would have no effect at all. 2.

Thirdly, If there were any such *Masonry* in the lying of the parts of water as might answer some way to the Figure, p. 21. all that artifice would be spoiled in boyling water or in water jumbled, in which notwithstanding there is as little *Gravitation* of the parts as in that which is quiet. 3.

C.

Fourthly

4.

Fourthly and lastly, Supposing there were this *Masonry* in water, this will not destroy the firmness of my demonstration from the round board at the bottom of the Bucket, since the Diameter of the bottom of the Bucket may bear such a proportion to the altitude of the Bucket, and so little distance left betwixt the round board and the sides of the Bucket, that there will be a great Horizontal section of the Cone in the Air above the Bucket or surface of Water in it, whence the residue of this supposed hollow *Arch* impendent on the residue of the Cone must needs fall to it, and consequently the whole Cylinder of water over the board gravitate on it, which shall be, suppose, 30 times more than that hollow Cylinder which is contained betwixt the convex of this Cylinder of water and the concave of the Bucket. And yet shall the
round

round board ascend. This is plain enough already, but if there could be any scruple, I could so encrease the proportion of the diameter of the bottom of the Bucket to its height, that the very remainder of the Cone shall be, suppose, 30 times bigger than the remainder of the Vault that environs the Cone, besides * other ^{See Remark 20,} ways by which this invention of the Cone or Cap in the subjected body in the water will be plainly apprehended to be only a witty Invention.

Upon Chapter the Fifth.

REMARK the Tenth.

THose words p.30. l.9. [*That it is certain, water hath an intrinsecal Gravity of its own as it is an heavy body*] these words are the most clearly understood, whether they be true

or false, from what I thought we were agreed on in the first and second part of my first *Remark*, That *Gravity* is nothing else but *mobility*, and *Gravitation* nothing else but *motion* or *nisus ad motum*. *Gravity* therefore being nothing else but *mobility* or a capacity of being moved downwards; this capacity is most certainly in it *intrinsically*, and indeed in all other bodies besides. But if by *Gravity* should be understood such a principle in water or any heavy body else, as by virtue whereof they would upon occasion move themselves downwards, That I make account is not at all certain but rather false.

REMARK the Eleventh.

Water so long as water, p. 34.
l. 21. is ever in its *fluid* consistency, and therefore sometimes
does

does gravitate in its fluid consistency, that is, has an actual motion or an actual *nifus ad motum ad centrum Terræ*. But that pressure it seems to have, p. 35. l. 1. upon Quick-silver in a Vessel, is but *ex accidenti* towards the center of the Earth it aims at the thin matter in the *Torricellian* Tube, or rather to reduce the matter to a due *equilibrium*. Nor does it press upon the Quick-silver but with it, and *vis unita fortior*, as appears by the rising of the Mercury in the Glass.

Upon Chapter the Sixth.

REMARK the Twelfth.

THAT a Bucket of Water should be as much one continued body as a Bucket of Pitch or Wax, is to me a Paradox, p. 42. l. 10. This cannot be unless the water were frozen.

And Pitch, and Wax, and Butter, and Ice, applyed to the fire, and so having their parts put upon motion, and thereby being made *fluid*, show plainly the nature of *fluidity* that it consists in smallness of parts and the slippery motion of them one by another, which in water is very eminent; and their *discontinuity* is notably discernible also in that they are so exhalable by the Sun, and do so easily convey themselves into piles of Wooll, a Vessel of Water placed in the room, if that experiment be true, as I never heard it contradicted,

REMARK the Thirteenth.

I only take notice here, p. 42. l. 14. that this learned Authour is mistaken in his Notion of the *Principium Hylarchicum*, which so oft occurs in my *Enchiridium Metaphysicum* *. For I do not under-

* See Difficiles Nugas. Remark 9.

understand thereby any *intelligent* Nature, but *vital* only, or at least mainly: I mean a Spirit indued with the *plastick* power of ordering the matter according to certain general Laws which the Divine Wisdom hath *vitally* and *essentially*, though not *intellectually* implanted in this *Spirit of Nature* as I else-where call it. For that there is no *life* but what is *Cogitative*, is a conceit taken up but yesterday, and I believe will as soon expire. That it is *Plastical*, and that it is not *intelligent*, these two things I think I can and have demonstrated; but whether it may have some more sleepy drowsie sense in it also, I have not yet determined, and for the present think it hard to prove either one way or other, and I am loth to assert any more than I can prove.

Upon Chapter the Seventh.

REMARK the Fourteenth.

THE distinction of considering water as a *solid* body and as a *fluid* body (p. 49 & 50.) does not go well down with me. For Water so long as it is Water and not Ice, is always fluid, even then when it is enveselled; and if its entire tendency then towards the earth argue its *solidity*, it is a solid body also out of the Vessel, for it also then tends entirely and directly towards the earth, as is seen in the drops of Rain. Wherefore we see no reason of reducing of enveselled water to the nature of a *solid* body, that upon that pretence the problem of its parts not gravitating one upon another may be thence solved.

R E.

REMARK the Fifteenth.

The *Non-Gravitation* of the particles of water (p. 52. l. 1.) upon subjected bodies, is resolved into two Accounts. The first *Mechanical*, the second *Natural*. The *Mechanical* is proposed and applied in this Seventh Chapter, the *Natural* in the next. The *Mechanical* account is two-fold; The first from the *Continuity* of the particles of Water, the second from their *Architecture* or *Masonry*, supposing they were not continued. Now that that Account from the *continuity* of parts, whereby the Learned Author would have it to be a kind of solid body, That this is invalid appears from the 3. and 12. Remarks. And indeed *discontinuity* of the parts of water is palpable from their extreme softness to our very fingering: as
when

when any thing is ground, the smaller the Powder is the softer it feels to our fingers, and *continuity* is nothing else but the fixt-ness of part to part, whence hardness would necessarily arise, as appears in Water turned into Ice, which is nothing else but the fixing the aqueous parts one to another.

REMARK *the Sixteenth.*

And therefore* this Learned Authour does well (*p. 52. l. 21.*) to admit at length, That water has the nature of separate bodies, and that its parts are only *contiguons*. But then when he flies for a solution of the present problem (why a whole column of water does not gravitate on the subjected body) to his Instances (*p. 53. l. 8.*) of a Pyramid of square Stones, a heap of Wheat and of *Callice*-sand, wherein an
Arch

Arch is made over the subjected bodies, &c. the invalidity of this Reason I have abundantly discovered in my 4. 5. 6. 7. 8. and 9. Remarks. There is no comparison betwixt those gross parts in Rest, and these infinitely small particles of water, which are in Motion.

REMARK *the Seventeenth.*

The Authour seems to affirm that the *Cartesian* aqueous particles are infinitely more improveable (p. 53. l. 8.) for making an Arch for the ease and security of subjacent bodies, than those of Wheat, Hail-shot or Sand, when-
 as doubtless they are infinitely less improveable, as being in promiscuous motion according to *Des-Cartes*, the *materia subtilissima* and the *globuli* intermingled, nor are they in any order but what they perpetually slip from;
 See Dif-
 ficiles Nu-
 gæ. Re-
 mark 6, 7,

♦ Remark
9. 15.

from; and how perfectly they are dis-intangled one from another, and slippery, is manifest to our very senses, as I noted * before.

REMARK the Eighteenth.

• Remark
12. 15.

He supposes (p. 54. l. 6.) that the union of the parts of water are much more close than that of the Monads of *Calice*-sand, because the water is *quid continuum*, though *fluidum*. But I have * offered reasons that I hope are sufficient to evince, that it is not *quid continuum* but *contignum*; and I farther add, that the parts of Sand being crammed so hard together and at rest, come nearer to the nature of *continuity*, than where the parts are in motion and come closer together, as it is in water.

R E.

REMARK *the Nineteenth.*

The Learned Authour (*p. 57. l. 3.*) does acknowledge that in a Bucket of Water with a rundle at the bottom, if the bottom have an hole in it, the whole column of Water will gravitate on the Rundle, and not only a *Cap* or *Cont.* Here I demand how this hole at the bottom of the Vessel under the Rundle, the Water not running out, can concern the supposed Arch, and cause a whole Cylinder of Gravitation on the Rundle, if there was this *Masonry* in this Phænomenon and it were not to be salved by another Principle?

REMARK *the Twentieth.*

Again, upon what occurs, *l. 12.* That the Water will undermine a lighter body than the like quantity

quantity of water commensurable to its bulk, I would propound this experiment: Supposing the Bucket with an hole at the bottom, as before, and that heavier-wood-rundle almost equal to the bottom of the Bucket placed on it, and then a lighter-wood-rundle of equal diameter with the heavier placed on it, Whether the whole Cylinder of Water does not press on these Rundles, and not a Cap only, and whether notwithstanding the upper Rundle will not ascend? which is a sign that its ascending at other times is not to be imputed to the Architecture of the Arch so ingeniously excogitated by this Learned Authour.

But I will appeal to one Experiment more which will take away both these two mechanical Accounts at once, that of *Continuity*, and this of *Architecture*; and the Experiment is this: Let there

there be a Bucket, whose concavity is perfectly Cylindrical, and the diameter of the bottom 63 parts: Let there be another Cylindrical Vessel, whose internal diameter shall be 61 parts, external 62: Let there be at the bottom of this Vessel 4 little equidistant holes in the sides sloping inwards so as to come just to the bottom, that the Water may no otherwise go out than just from the bottom upwards, nor ascend at all but by pressing to the bottom first. Put this Vessel into a Bucket to the bottom thereof, and hold it there so as that the top of the Vessel shall be equal to the top of the Bucket. Then pour in water till they be full to their brims, then take away your hand that held the Vessel to the bottom of the Bucket. The Vessel in the Bucket will rise up higher and higher till there be no more thereof immersed

immersed in water than is equal to such a *moles* of water as is equal to the whole Vessel in weight.

The weight of the water on the bottom of this Vessel is near upon thirty times more than the water betwixt this Vessel and the sides of the Bucket, which should undermine it, and yet the Vessel rises, of which no account can be given, neither from the *Continuity* of the water; for the water in the Vessel is not continued with the exterior water in the Bucket, but is only contiguous to the sides of the Vessel: nor from that *Masonry* of an *Arch* upon the Rundle or bottom of the Vessel; for the whole *moles* of the water in the Vessel does as much entirely press on the bottom of the Vessel, as the whole *moles* of water in any Bucket does upon the bottom thereof. So wholly ineffectual
are

are these *Mechanical* Inventions of *Continuity*, and the *Arch* or *Cone* on the subjected bodies in water, for solving the *Non-Gravitation* thereof. We shall now examine the Natural Account.

Upon Chapter the Eighth.

I Observe that the Authour (*p.* 58. *l.* 13.) lays the main stress of all upon this *Natural* Account of the *Non-Gravitation* of Water, either upon its inferiour parts, or any subjected body heavier or equal in weight to the like bulk of water. *For this*, says he, *I take to be the true natural specific reason of the Non-Gravitation of Fluids, though the Mechanical reason before given is not wholly useless, but contributes its part to it.* We will therefore be more diligent in examining this *Natural* Account.

D

RE-

REMARK *the Twenty first.*

And for the better procedure in this business, upon his mentioning the *intrinsecal Heaviness* of a body, *p. 59. l. 16.* we are here to remember what we were, I thought, agreed upon in my first Remark, part the first and the second; That *Heaviness* or *Gravity* in a Body, is nothing but its *Mobility*, nor *Gravitation* but its *motion* or actual *Nisus ad motum*, and that that Notion of *Gravity* in the Schools is but *Idolum Fori*. That mobility and motion upwards is as intrinsecal to a body as mobility and motion downwards. That there is no motion nor *Nisus ad motum* discernible in water to any term, but when it is misplaced, so that all such motion is only upon occasion in it. And therefore when water ascends in

a Tube in such sort as is described, *Remark 1. part 4.* That *Mobility* and *Motion* upward is as *intrinsecal* to the water as its *Nisus* downward; for that *Nisus* downward is not but *pro re nata*, when it is misplaced. These things I hope will not be stuck at, if we have but recourse to my first *Remark* and the parts thereof.

REMARK the *Twenty second.*

This *Natural Account* of the *Non-Gravitation* of *Fluids*, which the Authour lays so much stress upon; is this, p. 62. l. 5. That they have *several lines* of their *direction* of *Gravitation* (that is of their *motion*, by Remark the first) and therefore necessarily one must be *refracted*, *impeded*, and *abated* by the other; and consequently the *direction* of its *perpendicular* or *lateral Gravitation*

(or motion downward) is corrected or very near wholly suspended by the other tendencies or directions of its motion. This is the Learned Authours Natural Account of the Non-Gravitation of the parts of water upon water, &c.

REMARK the Twenty third.

The Learned Authour brings in again (p. 63. l. 5.) the notion and distinction of the *terminal* motions or tendencies of water as it is an *heavy body*, which are perpendicular towards the earth, which he calls the *primitive Conatus* of all heavy bodies and the effect of their *intrinsic Gravity*; and the other motions and directions as it is a *Fluid body*. This distinction he repeats again, p. 68. l. penult. Which language if we will uncipher according to our agreement in my
first

first Remark, the sense is this, That water as it is a body *moveable downwards*, or has an *intrinsic mobility downwards*, has its direction towards the earth. But here I demand, If the *mobility* of water *upwards* be not as *intrinsic* to it as *downwards*, and the one *conatus* as *primitive* as the other, since they are both only *ex data occasione*, by the waters being misplaced? for where the water is rightly placed, it has no *terminate* motion at all, and therefore all the directions of motion in water as to *primitiveness* or *intrescalness* are of the same kind. And it has, as all other bodies have, a *mobility* every way, but their *actual nifus* or *motus* is *pro re nata*.

REMARK the Twenty fourth.

And the Learned Authour, from p. 63. to p. 66. has abundantly

dantly well proved this *mobility* of water or its parts, that *datâ occasione* it will be moved upward, downwards, horizontally, obliquely, and indeed every way, and that to opposite terms in the very same lines. That is, that this may be caused at several times, and upon several occasions. But that water has all these tendencies or pressures at once, that his experiments will no way reach to. This I think will plainly appear to any one that considers well my first *Remark*, part 3. 4. and 5.

REMARK the Twenty fifth.

In his description of this his *Natural Account* (*Remark* 22.) he declares that by the many other directions and tendencies in a fluid body, the perpendicular is very near wholly suspended, but here (*p.* 68. *l.* 27.) that
it

It possibly may be, that the line of direction in a perpendicular descent may be considerably stronger and more efficacious, and consequently the Gravitation stronger, because there contributes to that motion, not only the nature of water as a *fluid body*, but also as a *heavy body*. But besides what I have * above noted, that the distinction betwixt a *heavy body* and a *fluid*, where one and the same body is both heavy and fluid at once, is not so congruous, and that there is * no such primitive *Gravity* or *Gravitation* distinguishable from the *mobility* and *actual motion* or tendency of any body downwards: admit this intrinsic *Gravity* or *Gravitation* over and above to the *mobility* and *motion* of the water downwards, yet seeing the *mobility* and *motion* of the water upwards is as urgent and nimble as that downwards,

D 4: they

* Remark
2, 14.

* Remark
1, 10.

they do one utterly defeat another, and for all these the water retains its *intrinsic Gravitation still*, so that this invention seems utterly useless, and the parts of water would press upon one another notwithstanding this Hypothesis. But if this *intrinsic Gravity* be a mistake of the Schools, as I doubt not but that it is, then that inconvenience will return which I mention in my first *Remark, part 5*. That a Bucket of water will have no more heaviness in it than if it had no water in it, which is contrary to experience, which are plain indications of the invalidity of this *Natural Account*.

R E M A R K *the Twenty sixth.*

He says notwithstanding, (*p. 70. l. 9.*) That if the line of the perpendicular descent of the *Fluid* be compared with all those various

ous

ous and many lines of its direction, &c. that the perpendicular motion of its Gravitation as an *heavy body* will be near altogether abated. But it is to be observed, that take all those various motions in, whereby it may seem hopeful that the *intrinsic Gravitation* will be abated, they will yet contribute nothing thereto, because there is no tendency in any one line of them, but there is an equal contendency in the same, so that their force is every way utterly defeated, as I noted of the perpendiculars before.

REMARK *the Twenty seventh.*

What he is observed to say in the former *Remark*, he farther illustrates and confirms (p. 71. l. 13.) by a like instance of *Callice-sand*, where he supposes their perpendicular Gravitation so hugely abated by their motion
per

per declive, and repeats the advantage Water has above the *Callice*-sand, because the parts of water are conjoined in one *continuum*. But that it is quite contrary I have * above proved concerning the *continuity*, as * also in that kind of perpendicular Gravitation, which is not *pro re nata*, but *intrinsic*. But we will here farther add, That if there were any such thing as *intrinsic Gravity*, every upper part would press on the lower, and the greatest pressure would be at the lowest, the least at top. So little service does this conceit of *Continuity*. And every grain of Sand where ever sited, would *ad summum virium* thrust downwards.

* Remark
12, 16.
* Remark
10, 21, 23,
25.
See also
Difficiles
Nugæ. Re-
mark 2, 10,
11.

REMARK *the Twenty eighth.*

But that they do not thrust so peremptorily downwards, he says
(p. 72.

(p. 72. l. 10.) the cause is apparently beyond all contradiction, that the accidental tendency of the Sands *per declive* doth break the *perpendicular* Gravitation, so that it does not gravitate upon the most fragil subjected body in its full weight. That this is no such apparent cause, besides what we have noted * above, that in the * Remark foregoing *Remark* does further^{8.} confirm, if there were any such thing as *intrinsic Gravity*; and though the Sands tumble *per declive*, it does not at all follow when they are stopt and rest, that they press *per declive*, but *downwards*. That an Animal therefore is not damnified under an high heap of Sand, may have some such reason as the suspension of *Fluids*.

REMARK *the Twenty ninth.*

Touching the further explanation

tion and enforcement of this Natural Account of the Non-Gravitation of the parts of *Fluids* in a Cubick foot of water, which he supposes just *twelve pound weight perpendicular*, (p. 73. l. 3.) and that it is the common stock of all its pressures (p. 74. l. 2.) to be distributed as from one common Cistern through so many Pipes (l. 6.) to serve all those Gravitations or Conatus ad motum, for it hath not above twelve pound *intrinsic* weight to serve all these Conatus or Gravitations. Here methinks it is most apparently deprehensible, that where there is acknowledged to be no other stock of *intrinsic* weight but this twelve pound to be derived to those multifarious actual Gravitations, Horizontal, Oblique, and directly upward, and yet the virtue of this twelve pound perpendicular ponderancy is felt entire still, that all the other actual

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al Gravitations are mere imaginations of a curious mind and no real effects in Nature.

REMARK *the Thirtieth.*

Indeed the Learned Authour seems aware of this difficulty and propounds it as such (*p. 76. l. 3.*) but I must confess I understand not the force of his answer, though he says it is plain. For he says the *water in the Bucket* is as fluid a body as so much water in the Ocean, but the *Bucket of water* is as one solid body. The *Bucket of water* is the *water in the Bucket*, which cannot be *fluid* and *solid* at once. It is a perfect repugnancy in Nature. It is therefore most certainly a *fluid body* even in the Bucket, and will have all that belongs to a *fluid body* as such, all those several Gravitations, Oblique, Horizontal, and upward, if there were

were any such, and that upward especially, there being nothing to bound it or check it, which yet is of the greatest force to lessen the perpendicular Gravitation. But that there are none such, is manifest from the entireness of the *Gravitation downwards* in the water of the Bucket: Suppose 12 pound weight still, and were the bottom of the Bucket taken out at once as it hangs, the water would not as it comes out immediately spread *Horizontally*, but descend directly down. So that the *Horizontal* sallies are only *pro re nata* made, when the water cannot get down perpendicularly, nor attempted ever but *ex data occasione*, when the moving Principle is invited to act, which is true also of its *Gravitation downwards*, which is never *actual*, but upon the waters being misplaced. But to phantasie there is such a perpetual

Conatus

Conatus every way and strong pressure to no purpose, is too much a-kin to those *elastick* thrusts and croudings imagined by others in the air, or that furious every way agitation of the matter in the *Cartesian* Philosophy. The Laws of Nature assuredly are more orderly and still.

To all which we will add, That if this were the main reason why the parts of water do not gravitate one upon another in the Bucket, because the perpendicular Gravitation is so refracted, mitigated, and as it were brought to an *æquilibrium*, by the other Gravitations; it would necessarily follow, that the water in the Bucket being wholly turned into Ice, and so really becoming a solid body, whereby all those other Gravitations saving the perpendicular would be extinct, that the perpendicular Gravitation which was 12 pound weight before,

before, will be well nigh doubled, when as on the contrary it is rather lighter, proportionable to that moderate rarefaction it received in the congeling: which plainly demonstrates that those other imagined Gravitations were not actual before, but that they are only made *pro re nata*, as I have intimated in my first Remark, part 4.

UPON

UPON
DIFFICILES NVGÆ;

O R,
 OBSERVATIONS

Touching the
TORRICELLIAN EXPERIMENT.

HAVING by the former *Enchirid.*
Remarks cleared my De- *Metaphys.*
 monstration of the ex- *cap. 13.*
istence of the *Principium Hylar-*
chicum, or *Spirit of Nature*, by
 that Experiment of the Wooden
 Rundle rising from the bottom
 of a Bucket of water, from what
 obscurity or uncertainty the In-
 vention of the *Cap* or *Cone* and the
Every-way-Gravitation, or Ten-
 dencies of motion imagined in
 Fluid bodies as such, might in-
 E volve

* *Enchirid.*
Metaphys.
cap. 12.

volve it in: I shall now chiefly raise such *Remarks* on this *second Treatise*, namely the Authours *Observations* touching the *Torricellian Experiment*, which will make good a like* demonstration of mine from the ascending weight hung at the *Embolus* of the *Air-pump*, against this Learned Authours solution thereof, and of all such like Experiments. The cause whereof he lays chiefly on *Rarefaction* and *Tension* of matter, &c. which he supposes to be real affections of *Nature*: and therefore I shall take these Notions at the first Rebound, as they occur in the second Chapter of this present *Treatise*.

Upon

Upon Chapter the Second.

The First REMARK.

THE Learned Authour here takes up Principles unproved, p. 21. and such as cannot be proved by any Experiment or Reason in Nature, nay such as are repugnant to Reason, and absurd if we more closely canvase them, and more considerably search into them.

That he has not proved them but merely applied them, is plain to any one that will give himself the divertisement of perusing his Treatise.

And that they cannot be proved is manifest from the very Notion of *Rarefaction* and *Condensation*, and of *Tension* and *Restitution*, p. 21. l. 12. For *Rarefaction* and *Tension* is when one and the same corporeal substance oc-

E 2 cupies

cupies a greater space than before, but *Condensation* and *Restitution* when it occupies less. These are the general natures (which is enough for my present purpose) in which they agree, I mean *Rarefaction* and *Tension*, and *Condensation* and *Restitution*, which were rashly admitted by some ancient Philosophers as well as by modern, because they conceited there were no bodies in the Universe, at least near our Earth, whose parts were more subtil than those of the Air, or else phancied the Air an absolute homogeneous body, nor looked upon it as consisting of any particles. So confused were their notions of this natural *Phæ-nomenon*.

3. But that it consists of actual particles seems to me manifest, in that it is so easily divisible. The tender thred of a Spinner that hangs on a mans Hat, being able
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to divide it in any assigned part, which were a thing incredible, did not the Air consist of parts merely contiguous, and that small ones too, and yet not of an infinite smallness; for as much as Air will not pass the pores of some bodies, though of other some it will.

And therefore seeing there is no *vacuum*, as is agreed on all sides, and that the parts of the Air are exceeding yielding to the least touch, which could not be if the main parts of the Air were of such Figures as would adequately fill all the space it is conceived to occupy; For then it would be so crammed that nothing could move easily or without forcible penetration of dimensions: Wherefore there must be particles to fill the little intervals betwixt the parts of the Air, and those exceeding small, that motion may be easie, and that

4.

the fluitant parts of the Air in this more subtile *Fluid* may nimbly yield to motion every way, as we see it does. This is one way of proving there are exceeding small particles in the Air, distinct from the main and more proper particles thereof.

But there is yet a more visible detection thereof in the *Phenomenon* of light, in that it passes the pores of Glass, which the Air cannot pass. And that light is a subtil body, besides the Authority of the Ancients, the Reflexion and Refraction of it makes it abundantly manifest. How can the figure of a body, as in a Burning-Glass, direct the rays so to one point, if they were a mere quality and not thinner particles of matter in the Air? And as for the conceit of *Species Intentionales*, which they make *Lumen Solis* to be in respect of his *Lux*: that it is an impossible Notion,

Notion, I have demonstrated in my *Enchiridium Metaphysicum*. Cap. 19. Sect. 2.
 These hints are sufficient in an Argument so easily allowed by all unprejudiced Philosophers to demonstrate, that there are * smaller parts of matter than those that are properly Aëreal, and such as can penetrate the pores of bodies when the Aëreal parts shall be forced to stand without. * See Remark 4.

From whence therefore it will plainly follow, That these Principles of *Rarefaction* and *Condensation*, of *Tension* and *Restitution* of the Air cannot be proved to be in Nature, in such cases as this Learned Authour and others phantasie they are. Because the coming in and re-ceding of the subtiler particles we have proved to be in Nature, will salve these Phænomena, and shew that it needs not be the same substance entire when it is rarefied, but subtiler parts may come in as wa-

ter into a Sponge; nor when it is condensed, but the subtil parts may go out as water out of a Sponge. And there is the same reason of the *Tension* of the Air and its *Restitution*; it may be salved by egress and regrefs of subtiler particles, and the *Tension* and *Restitution* like a Lute-string may be a mere conceit.

6. Nor are we content with this, but we also further affirm that it is *de facto* a mere conceit, as appears from that we have already proved, That the Air is so well replenished with matter far subtiler than it self, even such as will penetrate Glafs, and from what is acknowledged on all sides, that the Air is also compressible. For from hence it will necessarily follow, that upon the compression thereof, that there may be *no vacuum*, or by a necessary circle of motion, those smaller particles will pierce any
Glafs,

Glass, as suppose the Glass-Tube in the *Torricellian* Experiment, of which we shall speak more particularly in its due place.

Besides, the very notion of such a *Rarefaction* and *Condensation*, *Tension* and *Restitution*, as this Authour would have, is contrary to the nature of a body, which the ancient Philosophers defined τὸ τετραδίδαστον ἀντίτυπον, a substance of trinal Dimension and impenetrable. And impenetrability of body or matter is so generally acknowledged as a real and inseparable property thereof, that even those Philosophers that are for such a *Rarefaction* and *Condensation*, as *Aristotle* has broached, and this Authour maintains, have laboured tooth and nail, though in vain, to defend it from that absurdity of penetration of Dimensions. To say nothing how it is a mere confounding of the properties of
Body

Body and Spirit. For such a *Rarefaction* and *Condensation* as is here supposed, is too like the *Dilatation* and *Contraction* that belongs to particular Spirits.

7. And lastly, if we consider more punctually and precisely, That if there be this *Rarefaction*, it must be either by encreasing the bulk of every Particle, suppose of Air, thus rarefied, or by encreasing the number of the Particles (every Particle (a wonderful imagination!) sending Particles out of it self to occupy a greater room) both the emissitious and original particles in the meantime being without pores, at least so far forth as they are thus encreased (this new acquired extension being not by opening and filling of pores (as in the *Cartesian* way) but by new continued quantity, or at least newly emitted) It is, I say, here manifest, That if the encrease

crease of the Particles be in bulk (since there is no other imaginable or at least rational notion of *solidity*, but *Impossibility* of matter, and close *continuity* of parts undivided into particles (For natural experience teacheth us that looseness of Particles is the Original of *Fluidity* and softness) those Particles becoming bigger, in some cases it may be an hundred or a thousand times, and being likewise solid; the effect of the *Rarefaction* would be, that the body rarefied would feel more gross than before, which is against experience. But however in the other case where the number is only encreased, those emissitious Particles by reason of their impossibility and close continuity of parts, are as really solid as those bigger. And therefore it is as hard to conceive that they can ever enter again into the particles out of which they were emitted.

emitted. To say nothing (since there is no *vacuum*) how hard a thing it is to conceit upon every such *Rarefaction* there is necessarily this crouding of hard or solid bodies into the like hard or solid bodies, so that they really penetrate, not pores but the very dimensions of one another, though thus hard and solid. And this in bodies unrarefied, and that upon slight occasions and small force, which I must confess to me seems hugely harsh & absurd, and plainly against experience, even in soft bodies as in water; those forcible experiments that disprove its Elasticity, proving therewithal the Impenetrability of its parts.

8. To all which I shall add, That this supposed Principle of *Tension* takes away all starting holes that might be sought in bringing in any interspersed vacuities or empty pores in bodies, which would be a Discontinuity or Discontiguity

contiguity of matter in the world, which this Tension is pretended a Fence against. And besides, if there were any such interspersed vacuities, so that matter might be driven up closer into them, that would still make my Demonstration from the Air-Pump more firm, and the ascending of the weight would be still the more marvellous, and require the more necessarily a *Principium Hylarchicum*, the Defence of which is the great scope of my present *Remarks*. But to admit so incredible and unconceivable affection in Nature as the *mutual Penetration of Dimensions*, even in hard or solid bodies, (for the littleness of them hinders not but that they are really hard or solid) is an Hypothesis so like the rude crouding and intolerable pressing, in that prodigious *Elasticity* of the Air, that I hope this ingenious Authour will be as cautious

tious how he over-firmly adheres to the one, as he has been judicious in exploding the other.

Upon Chapter the Third.

The Second REMARK.

THE Learned Authour says, That the upper parts, *p.* 30. of a Cube of Lead do not actually gravitate upon the inferior parts, because the upper are Mechanically impeded by the lower from their actual gravitation upon them; yet every Atom thereof contributes to the gravitation of the whole upon the Scale. The former he calls, *p.* 32. Gravitation *ad motum*, the latter Gravitation *ad pondus*. But it is very hard to conceive if there were any such thing as *Intrinsic Gravity*, that is, a nature in the Lead it self whereby it was carried downward,

ward, that it should not have every part of it *Gravitationem ad motum*, or *Conatum ad motum*, since no inferiour part can Mechanically hinder the superiour part from this *Conatus*, and every *natural Agent* is supposed to act *ad extremum suarum virium*: And that no parts are idle, appears from the *Gravitation ad pondus*, if there were any such *Intrinsic Gravity*. Wherefore in that they do not *Gravitate* one upon another, as they do when Lead and Clay are continued together, and the Clay undermost, *p. 31. l. 16.* is not from any *Mechanical continuity*, but from the same reason that is in *Fluids* of the same kind, the parts press not one upon another because they are not misplaced, but are ranged in that order that is agreeable to the Laws of that *Immaterial Principle*. But if the parts were not thus ordered by a Principle

Principle distinct from them, but their *Gravitation* were from their own *innate Gravity*, it were incredible, nay impossible that there should be a *Gravitation ad pondus* of the parts, and none *ad motum*. For if the *innate Gravitation* of each part of the Leaden Cube did not bear against its fellow downwards, there would be no bearing against the Scale at all; as is manifest to any one that thinks close on the matter.

The Third REMARK.

He says, p. 42. l. 16. That the reason why a Glass Tube of Oyl immersed to such a depth into a Vessel of Water, will some of it go out, but immersed lower it will stay in, and if lower, will ascend in the Tube, &c. is this; because there is a greater pressure or renitence in the last place than
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in the second, and in the second than in the first, and therefore less force is required to raise the superficies in this first case than in the second, and in the second than in the third. This is ingenious, but there is this obstacle to the truth thereof: For let the first place be A. the second B. the third C. And let us consider that the Oyl going out at A. the whole body of the water from A. to the superficies is raised up at once, and there appears no hillock of water above the Oyl at A. on the superficies or on a Vessel of Oyl above the water at A. supposing water let into a Vessel of Oyl after the same manner by a Glass Tube. Now besides that it is incredible that so little portion of water or Oyl effused at A. should at all be able to raise the whole bulk of water or Oyl in the Vessels, from the whole superficies where

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A. is (though never so little) towards the top of the Vessels; it is also further demonstrable that the increase of Renitence or Pressure of the water against its being raised higher in B. more than in A. and in C. more than in B. is not the reason that the Oyl in the Tube put in Water, or Water in a Tube put into Oyl, does not go out at B. and ascends at C. For it would follow, that a Tube of Oyl put into a Vessel of Water of a far greater diameter than before, suppose twice as great, and the Tube again immersed to A. that is, to an equal depth as before, the Oyl would not go out, since the bulk of the water from A. to the superficies is four times as big as it was before, and therefore the Renitence against being raised higher, should nigh hand increase in proportion. And yet the Oyl goes out at A. as before, notwithstanding.

notwithstanding this imagined Renitency. Whence it is plain it is not the force of effused Water in the Oyl, or Oyl in the Water, that can raise the Water or Oyl one Atoms breadth higher, but the preventing activity of that *immaterial Principle* that disposes all the parts of the Liquors in the Vessel, orderly and at once, there being no crowding nor pressing any way, one part on another. And that the Pewter Porringer full of Hail-shot weighed in Water, *p. 43. L. 23.* is found from the bottom to the top in a manner of equal weight, is not because it forces the superficies of the Water no higher in one position than another, but because the Water is no heavier at one depth than another, that is, is not heavy at all.

Upon Chapter the Fourth.

REMARK *the Fourth.*

P. 50. l. 23. **I**N this page the Learned Authour does in a manner acknowledge what I so diligently endeavoured to prove in my first *Remark*, *part 4.* For he compares the Air to a vast Net with small Mashs or *interstitia*, fitted gradually with parts more and more subtil, wherein he judges right, saving that by the comparison of the Net he would insinuate a continuity of the Air, which I have sufficiently disproved, *Remark 1. part 3.*

REMARK *the Fifth.*

The Compression of divers particles of the Air, saith our Authour, p. 51. l. 13. may render
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that compressed body of Air sensibly heavy: whence he inferrs, that we may not wholly exelude those Particles from all kind of *Gravity* before *compression*. For no weighty body can arise from the coalition of such parts as had no manner of *Gravity* before. The conclusion bears some show of concinnity with it; but methinks the Inference would be more safe, if one should argue from hence that there is no such thing as *innate Gravity*, since that which appeared a light body before, without adding any real quality, but by only thrusting the parts nearer together, it got a motion downwards. Which therefore implies that that motion is from some other substance, not from the compressed Air it self, and that fire, if it could be compressed, would also tend downwards. As the matter thereof does tend downwards plainly in

wood, but the parts of wood attenuated and agitated tend upwards in the form of fire; which is no obscure intimation that it is not any inward particular form or quality, that is that which moveth things upward or downward, but a distinct immaterial Principle that is the *orderer* and *disposer of the matter of the universe*, according to the more or less *solidity* in its *consistency*.

REMARK *the Sixth.*

He asserts in this *page 63.* as also *p. 51. l. 2.* That there is not that strict cohesion of one part of water with another, as with one part of air with another, and yet as I have above noted, the Air is dividable by the thred of a Spinner hanging on ones Hat; how dividable then and separable is one part of water from another, that is more easily disjunctible

ble than Air it self, and how unfit for such *Architeſture* of the imagined *Cone* or *Cap* in the former Treatiſe?

REMARK *the Seventh.*

After an experiment made with a Glaſs-Siphon with Quick-Silver and Water, the longer leg of the Siphon being 32 inches, the ſhorter 8. and the ſhorter leg having ſomething a larger Diameter than the longer (which experiment is thus: 1. He filled the ſhorter leg with *Mercury* till it ran up as high in the longer, that is 8 inches according to the law of Fluids, and ſtopping the ſhorter with his finger filled the reſidue of the longer with water, whereupon the *Mercury* in the longer leg ſubſided to two inches and a quarter, 24 inches of water driving it ſo far down, though 28 inches of water is the uſual counterpoize to

two inches of *Mercury*. 2: Having filled again the Siphon with Quick-silver as at first, and immersing it into a Tube of water 32 inches high, so that the column of water over the shorter leg was full 24 inches, yet those 24 inches drive the *Mercury* in the shorter leg but one inch down, and raised it one inch in the longer. 3. Having poured water into the longer leg of the Siphon, so that the *Mercury* subsided two inches, and as much flowed out at the shorter, and then immersing again the Siphon into the Glass-vessel 32 inches deep filled with water, the *Mercury* subsided near an inch in the shorter leg, and accordingly impelled the *Mercury* into the longer.) Upon this experiment, I say, he makes this observation, p. 67. l. 1. That notwithstanding the advantage of the larger Diameter of the shorter leg, the Gravitation of the
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the external water or any imaginary column thereof, was not half so much as the Gravitation of the Cylinder of water included in the Tube, he means, the longer leg of the Siphon, which I conceive to be a plain mistake; For neither is that larger Diameter in the shorter leg any advantage, but a disadvantage; the motion of Fluids being swifter out of a narrow passage into wide than *vice versâ*: nor is there any indication in all these experiments, that the Gravitation of the 24 inches of water in the longer leg does gravitate as much more as the column of water of 24 inches impendent over the orifice of the shorter leg. For in the first instance, where 24 inches of water drives the Quick-silver 2 inches and $\frac{1}{2}$ downward in the longer leg, it is because of the largeness of the Diameter of the shorter leg, or by reason of its wideness.

wideness. So when the 24 inches of water and the Quick-silver was to balance against it, it required more Quick-silver to be at a counterpoise with it, than if it had had the same Diameter with the longer shank; and hence it is, that the Quicksilver subsides so far in the longer shank, and not the discontinuity of the water in it from other water. And now we come to the second instance, it is to be noted that the impendent column of water driving the *Mercury* one inch downward in the short leg, and so consequently raising it one in the longer, that there will be 9 inches in the longer leg, and but 7 in the shorter; so that upon the matter the column of 24 inches in the water poizes as much against the Quick-silver in this experiment, as that water in the longer shank did in the former. For here it ponderates against 2 inches

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es of Quick-silver, there but against 2 and $\frac{1}{4}$; nay I may safely say against above two in this; For if it was driven down one inch in the shorter but wider shank, it must needs rise above one inch in the other; and I doubt not but a quarter of an inch or thereabout, if the Author had taken so punctual notice of it. And as in these two instances in several, the column of the water in the water is found to be æquiponderant to a column of so many inches in the longer shank of the Siphon, so we shall find them in this last and joint experiment. For upon the pouring water into the long leg of the Siphon there remained but 6 inches of *Mercury* in that leg, and 8 in the other, wherefore upon the immitting of the Siphon into the Glass-Tube, and there being found about an inch subsiding in the shorter leg, and

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a rising as much in the longer; it is manifest that in each leg there was about 7 inches height of Quick-silver a piece, and that the column of water in the water gravitates as much as the column of water in the longer Shank of the Siphon, and not only half as much, as our Authour would have it; which is an excellent experiment against his supposed *Masonry* in the element of water, and that each part of water by each part doth most glibly slip: And that therefore this imaginary *Architecture* can contribute nothing to the rising of the round wooden Rundle from the bottom of the Bucket, on which I build that notable demonstration of mine in my *Enchiridium Metaphysicum*.

Upon

Upon Chapter the Fifth.

REMARK *the Eighth.*

THat experiment of *Stevinus*, that a Rundle placed on the bottom of a Vessel with a hole in it, so that the Rundle somewhat overlaps the hole, *p.* 94. *l.* 4. that the Rundle will gravitate upon that hole and the incumbent Cylinder of water commensurate in base to that Rundle so hard and close, that it requires a weight in a pair of Scales near commensurate to the weight of the impending Cylinder of water to raise it from the bottom; I say this Experiment is an Argument against that Invention of the *Cap* or *Cone*, and the rest of that *Architecture* in the foregoing Book. For the hole under the Rundle cannot be conceived any *Mechanical* cause at all, why the same
Archi-

Architedure may not be that was imagined before, and yet the Rundle ariseth not in the Vessel, nor does the water file thorough.

REMARK *the Ninth.*

That the Rundle ariseth not in the Vessel the Learned Authour offers this reason, because the water gravitates now upon the Rundle, as having mediately a lighter element, namely the Air upon which it gravitates, *l. 23.* But being as firmly sustained as before from passing to the Air, why should it gravitate any more than before? And besides if the bottom of the Bucket be somewhat higher than the Basis of the Ribs of the Bucket on which it may stand, and there be a second bottom made to keep the Air betwixt this second bottom and the former perforated bottom from communicating with the
rest

rest of the Air; it is worth the enquiring whether the Rundle then will not rise, because the *Abituriency* of the Air which was in the other case, is thus sufflaminated? Whence it would be plain, it was not simply because there was Air beneath, that the water gravitated on the Rundle, but because that Air was in the state of *Abituriency*, or at least in sufficient quantity to colluctate with the water, the *Principium Hylarchicum* upon such hints, by reason of the quick motion of those Laws of Life in it, putting this under-Air into that *Abituri-ent* state, and therewithal carrying the water *raptu consensûs* into an actual tendency downward, and so thrusting the Rundle closer to the Hole, intangles it self in its own attempt, as not acting by free reason and counsel, but by some general Laws of instinct of life, which in some such by-
cases

cases do not further but hinder the effect generally produced by Nature. Whence it is evident that this *Spirit of Nature* is not the first Cause, which is the *Æternal Wisdom*, but a mere inferiour Creature. But this is but by the by.

REMARK *the Tenth.*

Our Authour mentions an experiment of an empty Glas-bottle carefully stopt, and sunk a great depth into the Sea, that the pressure of the water will break it a-pieces, *p. 95. l. 9.* And he resolves it into this reason, because the water presses against a lighter Element, the Air, though mediately through the Glas. But I say, that is not the adequate cause thereof, that it has a lighter Element near to it, but because that the Element is misplaced, for the upper part of the
water

water in a Vessel does not press against the Air in the Vessel that is incumbent on it; but if a Bottle of Air were let down into the Sea with its mouth downward, and well stopt to keep out water, yet the water will thrust the Cork upward and drive it in. But that is because the Air is misplaced, and put in the Element of water, which methinks are very apert insinuations, that there is no such thing as *intrinsic Gravity*, but that matter moved is moved by a principle distinct from it self. For the parts of the water of the Sea do not press one against another, neither before nor after the Bottle is let down, and yet there is such a pressure on the Bottle once let down, that either the Cork is driven in or the Bottle broke in pieces. The other two instances also the Authour mentions in this page tend to the same purpose, I mean those of

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Oyl

Oyl driving Water upwards, and Water Quick-silver, of which he declares p. 96. 1. thus. *For in these instances though the immediate contiguity be of the heavier body to the lighter, as Oyl to Water, and Water to Mercury, yet the Air being behind the Mercury in the longer leg of the Siphon, and behind the Water in the Tube, the Water in the one case and the Oyl in the other, doth in truth gravitate upon the Air mediately and effectively, rather than upon the immediate heavier fluid.* Which would plainly be a *Gravitation* upwards, and therefore the more harsh phrase and sense, but may justly insinuate to this Authour the reasonableness of their opinion that hold, there is no *inward Gravitation* at all, but that the matter is moved *pro re nata*, and ranged by the *Spirit of Nature*, according to certain Laws generally

rally good for the Universe, and essentially implanted in the said Spirit. And these last *Phænomena* are easily resolved into the first *Hydrostatical* Axiom in my *Enchirid. Metaphys. c. 13. sect. 10.*

Upon Chapter the Sixth.

REMARK *the Eleventh.*

THE reason assigned, p. 101. l. 6. why a small Glas- Tube of so many Inches long, and filled up with water, and stopt with ones finger at the lower end, and let into a Vessel of Water of a competent diameter and depth, upon the unstopping of the lower end, all the water in the Tube above the superficies of the water in the Vessel will run down till it be no higher than the said superficies, namely, because if it obtain never so little more height

in the Pipe than in the Vessel, it has a greater force to press downwards than the water in the Vessel has strength to resist it; this reason I conceive does not quite exhaust the difficulty: For suppose this Pipe of but a quarter of an inch diameter, and a Bucket of a foot and a half, and deep a foot, and the Pipe 9 inches and half a quarter long, and 9 inches thereof in the water, so that there is but half a quarter of an inch of the water to press up by its force to some, though very little, height, a *moles* of water of 9 inches deep, and a foot and an half diameter, how is it possible that the force of *intrin-sick* Gravity of a Cylinder of water but a quarter of an inch diameter, and half a quarter of an inch altitude, should raise at all a Cylinder of 18 inches diameter and 9 inches in altitude, if some principle distinct from both,
did

did not assist? For the one Cylinder exceeds the other above some hundred thousand times, and yet the pressure of this little Cylinder must raise the great one by its own force, if there be no other *principle* to help, nor penetration of dimensions, which is even as absurd as the other. Or if you take the 9 inches of water more in the Tube into your compute, yet this added to the abovesaid Cylinder of but half a quarter of an inch high, will be above 5000 times less than the exterior Cylinder. So big is the absurdity still.

REMARK *the Twelfth.*

The falling off and sticking to of the *Obturaculum* in a Tube with a valve according as the Tube is less or more immersed in the water; my reason of this *Phenomenon* given in my *Enchi-*

ridium Metaphysicum, cap. 13. sect. 17. this Learned Authour says, p. 103. he is as much satisfied with, as with the reason of the excellent Authour of the *Hydrostatical Paradoxes*, but he alledges nothing against it but that it is an *obscure solution*. When as yet this I think therein is very plain and intelligible, that if there be what I declare, *quædam quasi sursum suctio Aëris in Tubo contenti, & conformis ac contemporanea aque compulsio in obturaculum GIH &c.* that that is a very solid Reason why the *Obturaculum* when this suction is strong enough (which is when the Tube is let down deep enough) by a circle of motion, or at least a joint compression of the water at the same time against it, should be kept up from falling. For upon this *ebullient* state of the Air, it being more vigorous than that impulse

pulse that should carry down the *Obturaculum*, (or rather that Principle that moves the matter being rapt into one consent of circular motion from the bottom of the Air in the Tube to the top, and then down into the water till it reach the *Obturaculum* under the Tube, urging the water as if it would ascend up, (which it would do but for the *Obturaculum*) in pursuit of the Air so drawn upwards, till it was even with the superficies of the water) it is manifest that the *Obturaculum* upon that *abitu-ri-ency* is driven upwards, and that the motion in order of Nature is first there in the air of the Tube; for as much as if the *abitu-ri-ency* of the Air in the Tube be stopt with a mans finger at a due nearness, or by a moveable *Embolus*, the *Obturaculum* that at such a depth clave close before to the Valve, will presently fall down,

which is a plain demonstration that the rise of the motion of pressure against the *Obturaculum* is from the air in the Tube first moved, according to that Law of the *Principium Hylarchicum* contained in my first *Hydrostatical Axiom*, *Enchirid. Metaphys. cap. 13. sect. 10.* which causes this joint motion or pressure against the *Obturaculum*. This cannot be obscure to any that acknowledge that a *Spirit* endued with *plastick life*, though devoid of understanding, and it may be of any acute sense, is able to move matter.

REMARK the Thirteenth.

And from what we have said in the foregoing *Remark*, it is evident I conceive that this Learned Authour is out in the account of this *Phenomenon*. For p. 110, and 111. he resolves the

the sticking of the *Obturaculum* to the Valve, into the Tubes pressing up a portion of water of a greater weight than it. If the Sucker, says he, (which answers to that which I call the *Obturaculum*) be drawn up (p. 110. l. 12.) and then immersed so low that the portion of water impelled up by the Tube does exceed the weight of the Sucker, the Sucker will be sustained by the pressure of the water upon it: But if the weight of a moles of water, saith he, commensurate to so much of the Tube as is immersed in the water, be less than the weight of the Sucker, the Sucker by its own weight will subside. That this reason is main, is apparent from hence; That if the Tube be let in so low that it raised a moles of water whose weight is much greater than the weight of the *Obturaculum*, or Sucker, and that for the present the *Obturaculum* will stick

stick to the Valve, yet if the Tube be stopt with ones finger, or rather by a moveable *Embolus* at a due nearness to the Valve, the *Obturaculum* will suddenly fall; whence it is manifest, that the Solution is not finally to be made into the raising of the water to several heights, upon which its pressure should encrease against the *Obturaculum*, but into the *abituency* of the Air in the Tube or just quantity thereof, and of the several forces of that *abituency* into the laws of motion, innate or essential to the *Spirit of Nature* or universal *Transposer* of the parts of the matter of the world. For where there is no raising of the water higher at a deeper descent to make its pressure greater in the immitting Air into Water, as in a Glass filled with Air and well stopt let down into the bottom of the Sea, upon a deep descent it will break, though

though upon a moderate it will not (though it raises the water alike in both cases.) Which is resolvible into nothing but the greater excitement of the force of the *Principium Hylarchicum*, upon the greater transgression of those *Hylostatick* laws vitally and essentially included in it. For the parts of water in water do not gravitate one against another, and they have as much room to play in when a Bottle of Air is sent down into the Water, as when a Bottle of Water of the same size is sent thereinto. But the Air in the former is misplaced, contrary to the *Hylostatick* laws of the Universe.

Upon

Upon Chapter the Seventh.

REMARK the Fourteenth.

IT is a very notable and pleasant Experiment the Learned Authour mentions, p. 118. l. 19. *It is most evident to any mans sense, quoth he, that will but try, that if a Tube be open at both ends and filled up with Mercury, and then one end stopped with the finger, and the other end inverted and immersed in the restagnant Mercury, whereby it descends from the top of the Tube, a strong and sensible attraction is wrought upon the pulp of the upper finger that closeth it, which continues and grows more and more forcible, sensible, and evident, the further the Mercury is removed from the upper end, and approaches to its usual station of 29 inches. This is his experiment,*

ment, which to me is a seasonable confirmation of what in the foregoing *Remark* I observed. That the force of activity in the *Principium Hylarchicum* or *Hylostaticum* is excited proportionably to the measure of misplacement of the parts of the matter of the Universe. But as for the Learned Authours solution of this *Phænomenon*, I mean of this attraction of the pulp of his finger at the top of the Tube, I must confess I am not at all satisfied with, and look upon it as a kind of Philosophical incivility, when-as so eminent a fellow Creature as this *Hylostatick Spirit*, took the opportunity of pulling him by the finger, when he could not shake him by the hand, that he would not embrace this offer of acquaintance, nor take notice of the existence of such a Being in the world, which I must confess, I think, this *Phænomenon* is a notable

ble evidence of, so circumstantiated as this Authour hath described; for it is not Impulsion *ab extrâ* as he describes it. For, says he, *most evidently the force the finger feels is from within and not from without*: and when he lays, it is upon the pulp of the finger and not the quitching of the skin, it is apparent that that force is in his very finger, not on the outside, whether in the Tube or without. And therefore it cannot be the contiguity of any body in the Tube, as our Learned Authour would have it, by which this attraction is made, but it is the *Hylstatick Spirit of Nature*, that upon unexpected occasions, after an unexpected manner moves the matter, and it was a kind of an attempt of this *Hylarchick Principle* to expand and rarifie the pulp of the finger to supply the absence of the Mercury. Its tugging therefore of the pulp of the
finger

finger toward the Cavity of the Tube, made the sense of the Attraction into it. But that this Attraction could be by no contiguity of any body in the Tube, appears from hence, that then it would have been felt more particularly and distinctly in the very exteriour skin.

REMARK *the Fifteenth.*

The other two instances out of *Honoratus Faber* which this Learned Authour brings, p. 120. seem to favour my sense of the first. For the Papyr extendible by force, but otherwise contracting it self, made fast at the upper end of the Tube, and upon the descent of the Mercury being extended, as also a Bladder so fastened and close tyed in the neck, and being blown out at the descent of the Quick-silver, both these seem effects of an ineffectual effort

effort in the *Hylarchical Spirit* of the world to supply that nakedness or emptiness of the Tube of that matter it ought to be replenished with, as far as it can, and that makes it extend the Pappyr to supply as far as it will go, and to blow up the Bladder by putting the grosser Particles in it upon motion, that is, rarefying what moisture there is in the Bladder, which, it is no wonder, when there is a hole in the Bladder, is not done, for then those Particles get out and are dispersed throughout the whole vacuity. But that the whole Bladder should be blown up by attraction, I shall take occasion * hereafter to show to be a mistake.

* Remark
32.

REMARK *the Sixteenth.*

That Aphorism of our Learned Authour, p. 122. That regularly all natural bodily effects are wrought

wrought by a contact of some active body upon the patient. This to me seems to contradict the *Phænomena* of Nature, and in motion confessedly so called, most numerously and universally, which is not, unless *ex accidenti*, *Mechanical* but *vital*. The descent of a stone is *vital*, as I have proved in my *Enchiridium Metaphysicum*, but its hitting or occurrence against any thing where-by it moves, that is only *Mechanical* motion in the thing so moved, otherwise motion is not by knocking or crowding, but by *vital* transposing of parts, as is most manifest in *Fluids*, the parts not gravitating one against another, but being jointly and freely moved by that *vital Principle*, which we call the *Hylarchick Spirit* of the world.

Upon Chapter the Eighth.

REMARK *the Seventeenth.*

OUR Authour reasons passing-well against a free permeation of the *Æther* into the Glass-Tube derelicted of the Quick-silver, because the Quick-silver then would subside to the bottom, as when there is but a hole at the top of the Tube no bigger than a Pins point, because then the Air he thinks may come in freely, so if the *Æther* could come in freely through the pores of the Glass, the Mercury would subside in that case too. But that the subtiler parts of the Air or *Æther* cannot upon occasion (though not so freely) penetrate the pores of the Glass, His Arguments for this Assertion seem to me altogether unsatisfactory. For if I understand him aright, the first thing he offers to prove it

it by, is, That if they could penetrate at all they would penetrate freely, and then the former Inconvenience would return. The second is a denial, or supposal that there are no such pores in Glass as any such smaller Particles can go thorough. But to the first I answer. That though the pores of the Glass be pervious enough to the *Æther* or subtiler parts of the Air, yet the *Remi-*
tency of the natural consistence of the Air will not for-go them but by some force, and a less pressure or force than of a column of Quick-silver of about 30 inches high will not prevail, any above it will. To the second, That in my first *Remark* I have hinted that (*part 4.*) which will sufficiently prove that there are pores in the Glass as well as particles subtiler than the Air to pass through them, as is apparent in the direction of the rays

to one point through a Burning-glass, against what our Authour here declares that there is only a *vis*, virtue or vigour corporeal, no substance that penetrates the Glass. For as bodies are only *tangible*, so they are only *reflexible* and *refractable*; To which you may add, that the lightness and fragibleness of Glass are farther Indications of its porosity. These things are so plain to the unprejudiced that it is needless to insist on them.

REMARK *the Eighteenth.*

And yet we may use a further confirmation of the subtiler parts of the Air passing the pores of the Glass, from the Authours own concession, *p. 128. l. 18.* that they pass not through the Mercury, as he conceives they do in the inverting a Glass-Tube of Mercury on the free Air, in
which

which case he observes bubbles ascending in the Mercury as it descends; but there being no such tumultuary motion of the Mercury in the *Torricellian* Experiment, he concludes, no parts of Air pass through the Mercury into the Tube. And therefore say I, it is the plainer case they pass through the pores of the Glass only in this experiment.

Upon Chapter the Ninth.

REMARK *the Nineteenth.*

OF which we shall be the better assured, after we understand that the Authours Reasons in this Ninth Chapter for the ascent of steams or vapours from the Mercury it self, *p. 139. l. 13.* are not sufficient. For the two ways that he offers for the separating these steams or vapours from the body of the Mer-

cury are, The *first*, expression or driving them out by the strong descent of the Mercury and compression of the inferiour parts by the superiour. The *other*, is extraction or straining out those parts that are more subtil and fluid, and capable of expansion, &c. To which I answer, that these two ways are in a manner one and the same, or at least the stress lies upon that one first, which if it fail the other will signifie nothing. And methinks it is apparent at least in such a case as this, that it will signifie nothing, namely, if the Tube filled with Mercury be immitted into the restagnant Mercury, very much inclining, and be raised to a perpendicular by degrees and leasurely, for then there being no such jolting of one part against another, but a gently bringing one part over another perpendicularly, and being so posited, they

they according to the law of Fluids not gravitating one part upon another in the Tube above the surface of the restagnant Mercury, and having but little under to gravitate upon, nor the restagnant Mercury (according to the same law of Fluids, even then when it was made something to ascend by the Mercury descending from the Tube) gravitating one part upon another, it is manifest there was no compression able to separate any particles from the Mercury and send them into the Tube.

REMARK *the Twentieth.*

The Authour himself raises a notable objection, *p. 141. l. 26.* against this opinion of Mercurial *effluvia* supplying the derelicted place of the Mercury in the Tube: Suppose, says he, the Tube were ten foot long, or the

H 4 upper

upper end were a Bolts-head that should contain 4 pounds of Mercury, this Mercury subsiding to 29 inches, where should there be *effluvia* to fill so great a space? His answer is, the more Mercury descends to 29 inches, the more *effluvia* there will be to fill the space; but I say if the Tube of Mercury be let down obliquely, as before, and be gently and leisurely raised to a perpendicular, according to the law of Fluids the compression will be even just nothing. From whence then can that vast empty space be supplied but by the subtiler parts of the Air coming in through the pores of the Glass-Tube? which is that we aimed at.

Upon

Upon Chapter the Eleventh.

REMARK *the Twenty first.*

HIS confutation of the use of the *Atmospherical Cylinder* in the solving of the *Torricellian Experiment* is very ingenious, p. 158. l. 4. namely from the supposal of a Glass-Tube half an inch diameter in Cavity, and as much in thickness of 3 foot long, and sealed at one end, filled with Mercury and immersed to the bottom of a Vessel of restagnant Mercury 7 inches deep, so that 29 inches and $\frac{1}{2}$ will be above the restagnant Mercury, the Tube remaining full to the top. But the Glass being lighter than the Mercury, it will be driven up thereby near to the superficies thereof. So that about 6 inches of the upper end of the Tube will be empty, but the Tube con-
tinue

tinue still 39 inches of Mercury and $\frac{1}{2}$, the bottom of it immersed but $\frac{1}{2}$ an inch; and the supposition is, that the 29 inches of Mercury and an half, weighs one pound, and the Tube just as much. This Tube of Mercury now in these circumstances fixed by a String to a Beam of a pair of Scales, two pound in the adverse Scale will counterpoise, and any little advantage of weight added will make it preponderate. Whence he clearly deduces from the Mercury's contributing the weight of a pound to the counterpoizing the Scale, that it is not sustained by a Cylinder of Air of equal diameter and weight with it self, for then there would be but that one pound weight of the Tube alone to counterpoize the two pound in the Scale; which is a firm and ingenious demonstration against the Hypothesis of the Atmospheres pressing the restagnant Mercury. R E.

REMARK *the Twenty second.*

Nor can it be eluded by saying, *p.* 161. *l.* 8. that though the column of Quick-silver in the Tube be indeed sustained by a column or Cylinder of Air of equal diameter with the column of Mercury in the Tube, and so weighs not at all against the Scale; yet a column of Air whose basis is the top of the Tube does ponderate upon it, and so supplies the place of the Cylinder of Quick-silver to which it is equal in weight. For since the diameter of the Quick-silver is but half an inch, and the diameter of the whole Tube $\frac{3}{4}$ of an inch, it is manifest, that the weight of the column of Air on the head of the Tubes, if it weighed at all in their sense, would be nine times as much in weight as that of the Mercury in the Tube, which is a very gross absurdity. RE-

REMARK *the Twenty third.*

And as weak a subterfuge is that whereby they would elude this Answer, namely by pretending, that the Glass-Tube being a body specifically lighter than Mercury, is it self sustained by the restagnant Mercury, as if that broke the force of the column of Air that presses 9 times as strong on the head of the Tube as the other column of Air on the restagnant Quick-silver; when-as it is a thing plainly prodigious that a single force should keep Mercury 29 inches and $\frac{1}{2}$ above the surface of the restagnant Mercury up in the Air, though it be I know not how many thousand times lighter than Mercury, and yet that the Glass should not be kept down 6 inches under the surface of the restagnant Mercury, though not fourteen times heavier

vier than Glas, by a force nine times as great as the former.

REMARK *the Twenty fourth.*

But the Authour does very handsomely meet with all such elusions by two neat experiments. The one is of a Glas-Tube, the Diameter of whose Cavity was $\frac{1}{4}$, the Diameter of the whole $\frac{3}{4}$ of an inch, the length 18 inches, the weight thereof in the Air 2 ounces $\frac{3}{4}$, the water it would contain, near 1 ounce $\frac{3}{4}$. This Tube tyed at the closed end to the Scale of a Balance, and being filled with water and stopt with ones finger, and so let down into water, and so settled there as that the lower end was near about a quarter of an inch from the surface, there was required in the opposite Scale four ounces and $\frac{1}{2}$, which is equal to the weight of the Water and Tube together to hold

hold the Tube in an *Æquilibrium*, and here the Glass-Tube is not held up by the restagnant water, the Glass being so heavy that it would sink to the bottom, as being a body specifically heavier than water. Wherefore this *Æquilibrium* being from hence, according to the Principles of those that hold the pressure of the Atmosphere, either because the Tube and the water jointly do weigh against the Weights in the other scale, or because the column of Air on the head of the Tube with the Tube weigh against them, this second being impossible, for as much as the diameter of that column is five such parts as the diameter of the column of water in the Tube, and that of Air on the restagnant water is four, and therefore would press at least half as much again as the water in the Tube, namely in the proportion of 25 to 16, which

which the Scale discovers to be false, for there is only one ounce $\frac{1}{2}$ added to the two ounces $\frac{1}{2}$, not $\frac{1}{2}$ of an ounce more; it remains that it is the Water with the Tube jointly that weighs against the Weights in the other Scale, for as much as the restagnant Water does not hinder the Tube: from whence it follows, that the water in the Tube is not sustained by any column of Air on the restagnant Water, which will be more apparent in the other experiment, which is this: He took, suppose, the same Tube, heated it very hot, and hung the closed end upon one Scale of a Balance, and let the open end sink a little into a Vessel of water, and counterpoized it in the other Scale with 2 ounces $\frac{1}{2}$, the weight the empty Tube weighed in the Air, which, because the end of it did little more than touch the water, it still retained, but

but within the space of half a quarter of an hour the Tube was filled 12 inches of its 18 with water, which 12 inches of water was found to weigh one ounce and $\frac{1}{4}$, and one ounce and $\frac{1}{4}$ more put in the opposite Scale, and the Scales held so that the Tube might only touch the surface of the water, the Tube with the 12 inches of water in it was found to weigh just 4 ounces. Now therefore since the Tube could weigh no more, if so much, on the top of the water, than it did when it was hung only in the Air, for the pillar of Air incumbent on the top of the Tube is the same in both cases, it is manifest, against the principles of those that hold the pressure of the Atmosphere, that the water in the Tube weighs its part, namely one ounce and $\frac{1}{4}$ to make the weight 4 ounces, and consequently that the water in the
Tube

Tube is not sustained by any pressure of a Pillar of Air incumbent on the restagnant Water.

REMARK *the Twenty fifth.*

That also is an ingenious demonstration against the opinion of the pressure of Atmospherical Cylinders, *p. 175. l. 9.* namely the inverting a Glass-Tube of Quick-silver, suppose of a diameter of 9. such parts as the Vessels diameter of restagnant Quick-silver is 10. so that it may be apparent that the Rim or round superficies of the restagnant Mercury in the Vessel, is not a full fourth part of the *area* of the Mercurial Cylinder in the Tube, and yet the Mercury in the Tube will be sustained as in other cases. Which therefore cannot be from the pressure of the Air on the restagnant Mercury, the superficies thereof being less than one fourth part to the

I

area

area of the Cylinder of Mercury.

REMARK *the Twenty sixth.*

And this last Instance surely is no wise to be contemned, That the *Torricellian* experiment will succeed as well in a great *Receiver* as in the open *Air*, when-as notwithstanding there can be no Atmospheric column on the restagnant Mercury in the Receiver, nor is there any refuge here to the *elasticity* of the Air, p. 186. because that supposes the *Gravitation* thereof, which has been so plainly disproved by the Authour, not only by these last Experiments, but in his 6. Chapter, and particularly by the two Brass Cylinders weighed in water of Diameters of a double proportion one to another, and the one side of a quadruple to the other. For things being so contrived that a
column

column of Air of two inches diameter press on the one, and not a quarter of an inch diameter on the other, the Cylinders yet shall be equiponderant in the water. The Experiment there has a three-fold improvement, and the very first strong enough, considering there is no *elasticity* or rebounding in the water, see p. 75. l. 4. though the Authour phantasie there is, and that equal weights pressed by unequal force, the stronger must prevail. And moreover if this *elasticity* of the Air were admitted, he does not unskilfully urge, that every part of the included Air does act so equally in a manner against every part every way, that there is a suspension of the pressure any way to any effect, &c. p. 194. l. 23.

Upon Chapter the Thirteenth

REMARK *the Twenty seventh.*

THat Experiment also of the Bottle and the Bolts-head is notably levelled against the *elasticity* of the Air, *p.196. l. 22.* That a Bolts-head soundly heated, and placed upon a Glass-bottle, with some six ounces of water in it, which may fill it about half full, but not so closely luted but that some Air, though but at a pins hole, may come in, the water in the Bottle will be wholly drawn up into the Bolts-head. But if the Bolts-head were hastily so closed that no Air could enter into it, some water would indeed rise as far as into the Shank of the Bolts-head, but the whole water would not ascend into the Bolts-head as before it did, which, says this Learned Authour, is a plain

plain argument against that huge *elasticity* of the Air that some imagine. For no fresh Air being let in by this strict closure, the force of the rarefied Air in the Bolts-head is more entire, and as he conceives the attraction more powerful to raise the water as before, if there were any thing near that *elasticity* in the common Air that is imagined there, that it can expand it self into 40 times a larger space if need be; nor would the weight, says he, of the interposed water be too great for the *Elatery* of the Air in this case to drive it up so high as before, since in a close Receiver it is able, according to their opinion, to thrust and keep up a column of Mercury to 29 inches high, possibly of a pound weight or more. Why therefore, if there were any such forcible *Elatery* of the Air, cannot it thrust up 5 or 6 ounces of water

I 3

ter about 5 or 6 inches high into the Bolts-head, which is rationally argued against that huge elasticity of the Air. But as for the Authours own solution of this Problem from *Tension* and *Attraction*, I am as little satisfied with, as he with their elasticity, and am reminded of that saying in *Pliny*, *Quid mirabilius esse potest aquis in cælo stantibus?* But the same miracle is in the Bolts-head, neither of which I can resolve into any meaner Principle than that which I call the *Hylarchical* or *Hylostatical Spirit* of the world. As for that of *Tension* we shall consider in *Chap. 14* and *15*.

Upon

Upon Chapter the Fourteenth.

REMARK *the Twenty eighth.*

HERE the Learned Authour does declare himself, that all those experiments which the *Virtuosi* would give an account of from the pressure and *elasticity* of the Air, p. 203. are plainly performed by *suction* and *Attraction* of the Air, when put under a greater *Tension* or *Rarefaction*; which I must confess I am much concerned to examine how true it is, in reference to what I have writ of the experiment of the weight hung at the *Embolus* of the Air-pump in my *Enchiridium Metaphysicum*. On Cap. 12. Sect. 2. which therefore I may touch something in this Chapter, but more fully discover the mistake of this opinion in the next, where the Learned Authour pretends to

I 4 deliver

deliver the true cause of the suspension of the Mercury in the *Torricellian* Experiment.

REMARK *the Twenty ninth.*

That the Mercury in the *Torricellian* Experiment, p. 203. l. 12. will fall 2 or 3 inches, as it shall be placed at the bottom of an hill or at the top of the hill, or upon the change of weather, is reasonable to me, because of the different consistency of the Air, which abounds more or less with the *materia subtilissima*, and so can more easily transmit it through the pores of the Glass with less violence done to its consistence: Which very experiment methinks to me is an argument against the opinion of *Tension*, and subtil parts coming from the *Mercury* it self, for then it were all one in what weather, or where the Glass were placed.

But

But the Mercury subsiding in clearer and colder weather, in higher places on the top of the hills, where the Air is not so much stuf with vapours, it is plain this change depends on the more easie entrance of the *materia subtilissima* through the pores of the Glass, and that the *consistency* of Air is not so strong there, but a lesser weight will break it than in a thicker.

REMARK *the Thirtieth.*

That upon a strong exhaustion in the Air-pump, a dry Bladder well tyed and blown moderately full, is broken, as likewise Glass-bubbles, &c. That a Bladder, the greatest part of its air squeezed out, and the neck tied very close, and a weight fastned to it and put into a large Glass filled with water to be placed on the Air-pump, and then covered with a
large

large Receiver well luted to the Pump, the Air pumped out of the large Receiver, this Bladder below the water would swell till by continuing the pumping it will be full blown. And lastly, that Water, Spirit of Wine, &c. will be raised to run out of a Glass, and that Bubbles will be formed at the bottom of an included Glass of Water in such a great Receiver, so that all is put into a various agitation; All this the Learned Authour resolves into the *Tension* of the rarefied Air in the Receiver: Which I must again confess I am as little satisfied with as he is with their *elasticity* of the Air, nor do I think either of them true; but this I think, that in the Bladders and Glass-bubbles, that break, there is a stronger agitation of the parts of the Air, and that it is that which materially acts against the inward-sides of the Glass-bubbles
and

and Bladders, not the *exteriour* matter by attraction, but there is a furious agitation of the interiour, which is not from any former *elasticity*, but which it acquires *pro re nata*, as furious winds are raised in the North in the great world upon dissolution of aqueous particles of the clouds, which furious and rapid motion it is impossible for them to acquire from mere heat, but from some higher principle, and the same principle I suppose to act here, being raised into a fierce or quick activity, to reduce the matter in the exhausted Receiver as near as it could to a consistency more sutable to the rest of the Air at this pitch from the Earth, but there is no heat in the Bladder or Glass-bubbles, or in the Receiver, that can so furiously agitate the matter in them; and that here is such a boiling agitation and bubling in water,

water, spirit of Wine, &c. it is a plain indication, that these things happen not by way of tension, but of excitation and a furious dispersion of the parts to thicken, as much as may be, the whole matter in the Receiver, that is so highly thin above the measure of matter so near the Earth, and amidst our crass Air. Not to speak of other things that may be alledged, which I shall reserve for the ensuing Chapter.

REMARK *the Thirty first.*

As for that Experiment in *Regius*, it is very improperly brought in, p. 212. l. 21. for such an *attraction* as our Authour stands for, namely such as is made upon this kind of *Rarefaction* and *Tension*. For there is not the least pretence to any *Rarefaction* or *Tension* of this kind in that experiment,

periment, but only a circle of motion in the Air, The mouth draws in the air into the *thorax* by one part of a Tobacco-pipe, and the *thorax* being distended presses the external Air, which find its way into the other Tobacco-pipe lighted with Tobacco in it, the smaller end immersed into the water; and through the water the air and smoke passes, and continues its course till it come into the other piece of a Tobacco-pipe, which, though it passes the close cover of the Vial, yet does not pass into the water it self; but falls short of it, and so getting into that piece of a Tobacco-pipe after it has passed through the water and got into the Air betwixt the cover of the Glass and water, it goes into the Tobacconists mouth, and so completes the whole Circle; but here is not one jot of *Tension* or *Rarefaction* of the Air all this time,

time, but only of the *Tobacco* which is turned into a fume. But that all the parts of the water to the very bottom of it, and the granules of Sand lying at the bottom of the water are put into a tumultuary motion, that is no wonder, (when-as the Air and smoke are forced to find their way through the water) and may a little illustrate and facilitate the conception of the true reason of those tumults and agitations of water and the spirit of wine above mentioned, observed in the exhausted Receiver, namely because a more subtil and active element came in through the pores of the Glass, as the hurry of the Tobacco-fume and Air through the water in this last experiment, and that they had a more than ordinary excitation in them from the *moving Principle*, for the reasons above specified: but that *Tension* has nothing to do

do in these things, I shall further confirm upon what occurs in the following Chapters.

Upon Chapter the Fifteenth.

REMARK *the Twenty second.*

IN this Chapter the Learned Authour lays down the true cause, as he conceives, of the suspension of the Mercury in the Glass- Tube in the *Torricellian* experiment, and he takes occasion to speak of three kinds thereof, but I shall take notice only of one, and that the chief of them, in which if I plainly discover his mistake, I suppose there will be no controverſie touching the other two. This experiment then is, when a Tube, suppose of four foot long, is filled full of Quick-silver, and so inverted and immitted into a vessel of restagnant Quick-silver, upon

upon which the Mercury in the Glass-Tube will descend to 29 inches and an half, and leave about 18 inches in the Tube destitute of Mercury. The reason of this *Phenomenon* the Authour gives to be this; The expression and ascension of some mercurial vapours or particles at large, forced up by the *agitation* and *pression* of the parts of the Mercury, and withal their *Tension*, that they may be able to fill so great a space as the 18 inches of the Tube devoid of the body of Mercury. This is his solution of this Problem. But the Reasons upon which this solution is built, are not sufficiently firm. For *first*, He supposes no Aëreal particles passing through the Mercury to get into the derelicted space of the Tube, that it must necessarily be the *effluvia* of the Mercury it self that ascends; when-as by the 3. and 4. part of
my

my first *Remark* there are such subtil parts in the Air that they penetrate the pores of the Glass. And then *secondly*, For the *pression* and *agitation* of the parts of the Mercury, the *pression* of Fluids on Fluids of the same kind, is nothing in a manner, and the agitation observed might be much diminished, if not wholly prevented by a leasurely oblique immision of the Tube, and so by degrees bringing it to a perpendicular; whence there would be either no mercurial *effluvia* raised, or else the copiousness of them so varied accordingly as they shall take heed to prevent the tumultuary agitation, that the suspension of the Mercury will not be the same at all times, but sometimes lower, sometimes higher. Nor is that *lucta* in the Mercury from the endeavouring of Nature to give *Tension* to the *effluvia*, but betwixt the weight

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of the column of Mercury, and the *resistency* of the consistence of the compressible Air. Nor *lastly* will that experiment of the Quick-silver, so forcibly rising against the top of the Tube, if it be suddenly lifted up, prove any such Lute-string-like *Tension* in the supposed *effluvia*. For in this case there is that, which this Learned Authour admits of, both phrase and thing, that is, *Gravitatio sursum*, and upon the more sudden plucking up the Tube, the consistence of the Air not letting in the subtil Element, and there being no *vacuum* any where, nor penetration of dimensions, the Air is driven upon the restagnant Quick-silver, and the restagnant Quick-silver into the mouth of the Tube, and so is as it were a flux of water into a far straiter Channel, and therefore it must there proportionably run the swifter. And this swift motion

tion in so heavy a body as Mercury must needs be the stronger and more peremptory, coming against so thin a body as that subtil matter in the Tube, even to the danger of breaking it. So that the whole is as it were a quick Gravitation *sursum*, by a circle of motion against that thin Element at the upper end of the Tube. Which plainly shows, that there is no ground for *Tension*, there being such reason for *Circumpulsion*. And thus I have shown the *groundlesness* of his *Reasons*, but in the next Chapter I shall discover the *repugnancy* of his *assertion*.

Upon Chapter the Sixteenth.

REMARK *the Thirty third.*

IN this Chapter he sets down the two suppositions he holds necessary for the maintaining of

his former solution of the *Torricellian* Phænomenon. The *first* is, that there is no *vacuum* in Nature. The *second*, that thin or subtil bodies are capable of *Tension*, and of *attraction* and *strong adhesion* to other bodies, and *cohesion* of one part to another, as in a Lute-string, as is his familiar illustration, saving that in a Lute-string the *Tension* one way straitens it another way, and makes the Lute-string narrower, but here the *Tension* and *Cohesion* is every way at once. As for the first, that there is no *vacuum*, it is granted, which makes his denial of the passing of any aërial parts or particles in the Air, through the Glass or Mercury, repugnant to his own supposed principle. For it being plain that the immersion of the Tube may be made so obliquely and leasurely as neither to press out nor fridge out any mercurial *effluvia*; it follows

follows there would be a *vacuum*; or if some few should arise, what would they do when the top of the Tube is like a Bolthead, containing the capacity of many pounds of Mercury, there must be a *vacuum*, or such a *Tension* of those few *effluvia*, that I should think it would exceed all belief in the very Authour himself. But let this go; There is enough in what remains utterly to destroy this Hypothesis of the Authour, I mean these two things comprized in the second member; mere *Tension* it self, such as is ordinarily supposed in an usual Tube, in the descent of the Mercury to 29 inches, and that *tough adhesion* and *cohesion* of the particles thus extended. For first as for the *Tension*, in a Tube so obliquely immitted and leisurely raised to a perpendicular, no man can rationally imagine one inch of *effluvia* either pres-

sed or fridged out of the Mercury by its descent; and if there were, and these taken or let out by some artifice at every trial, some 18 trials would lessen the Mercury 18 such inches of the Tube, which would prove very sensible. But though this were not, there would in the mean time by this *Tension* of one inch of matter into 18, be seventeen inches penetration of solid matter and hard, or else it would not be penetration, and this by so small a force as the weight of a Cylinder of Mercury of no greater diameter than would make it weigh one pound, when as the Authour himself acknowledges that an 100 pound weight will not press water so as to make it yield at all, and yet here upon the least gentle motion of the Tube from a perpendicular to an inclined posture, and from an inclined posture to a perpendicular,

lar, there shall be more or less penetration of dimension, as if that which wise and considerate Philosophers have held impossible, were as easie as the running an hot Bodkin into a pound of Butter, which methinks to any one that indifferently perpend the matter, must seem a clear demonstration against this solution of the Problem, as I have already noted in the sixth and seventh part of my first *Remark*; and what I have there already writ, will save me the labour of any further enlarging my self in this point.

But now for that tough and peremptory *adhesion* of this thin body in the Tube, to the top and sides thereof, and *cohesion* of one part thereof to another, and the lowest part to the highest part of the Quick-silver in the Tube, as if the top of the Tube were instead of so many *Peggs*,

and the upper part of the Quick-silver the *Bridge* of the Lute, and the subtil matter betwixt, under this actual *Tension*, so many *Lute-strings*, in virtue whereof the column of Mercury hangs suspended as a weight. This to me I must confess is unimaginable. For first I cannot but conceive, that if I could come to this thin matter, which is thinner than Air it self, I could cut through it with a Spinners thred, or by any other line subtiler and weaker than it; nor can I imagine that that which can be so easily cut asunder, holds so fast together, as that it will sustain in this experiment one pound weight, in some others it may be some hundreds. Besides, if every part held together so toughly, no Flie could move in it, nor Flie nor Feather fall down from the top of the Tube to the upper Basis of the mercurial Cylinder,

linder, which is against experience, but they would hang like dust or flies on the webs of Spiders, or indeed the whole consistence of that subtil matter would be viscous or glutinous and so impassable to them. To all which you may add, If it had this strong retraction as a *Lute-string*, it taking hold only on the upper part or surface as it were of the mercurial Cylinder, it would pluck up the *Bridg*. Wherefore the mercurial Cylinder is not held up by *Suspension* but by *Circumpulsion* and *Gravitation* upwards, if I may use the language of this Authour, the Air and Quicksilver both gravitating against the thin subtil matter in the upper end of the Tube, through the Mercury in the lower end, as the water does against the stopple of the Valve in the * above-mentioned * *Remark* experiment, that is, there is a ^{12.}
sistency

sistency of them in this *order* and
Libration by the *Hylostatick Spi-*
rit of the Universe, which also
 directs the motion of heavy bo-
 dies downward, of which this
 learned Authour does ingeni-
 ously confess men have tired
 themselves in vain to find out
 any *mechanical* cause, and I have
 in my *Enchiridium Metaphysicum*
 proved that it is contrary to the
 laws of *Mechanicks*. And he
 seems to resolve these things in-
 to *Nature*, which is the *Principium*
motus & quietis, as *Aristotle* de-
 fines, and also declares of her,
 That *Natura nihil agit frustra*.
 Whereby, but that his words have
 stuck in his teeth and he hath
 not spoke out, *Aristotle* acknow-
 ledges what I contend for, a *Spi-*
rit of Nature or *Hylostatick Prin-*
ciple, which he must of necessity
 acknowledge, unless he contra-
 dict himself, for as much as he
 makes matter *merely passive*,
 which

which it cannot be, if what moves it and orders it be but a *modification* of matter, and not a *Spirit* distinct there-from: for that *modification* would be from its own essence, and consequently it would be *self-moved*, and move it self so, (unless we play tricks with it) that it does *nihil agere frustra*, which is far from being a mere passive Principle. But this is more than I intended to say upon this occasion. We have plainly enervated the main of this Chapter; what little matters remain, we will dispose into the following Remarks.

REMARK *the Thirty fourth.*

The Learned Authour endeavours to prove the *attraction* of *tensed* bodies, p. 239. l. 12. from Nature's affectation of a strict *contiguity*, it being a kind of *continuity* of the Universe and
all

all its parts. But I observe, if there were any such *attraction*, the *final* cause only is there indigitated, but we seek after a natural *efficient* cause. And I deny moreover that there is any scope in the suspension of the Mercury to save the Universe from *discontinuity*, but only to preserve the Air in its due *consistency*. Nor is the Air the *common Cement* of the parts of this inferior world, but it is one *common Spirit* that holds the parts of the whole Universe together, no *Atomi hamatæ*, or any such corporeal contrivances. And where the matter is never so subtil, the contiguity of the world is as much as where it is more crass. And therefore where we see strange things done upon any place, being filled with only extreme subtil matter, it is not because there is any more fear then of *discontiguity* or a *vacuum*,
but

but because that matter is misplaced, and the *Hylostatick Spirit* of the Universe would dispose of it better.

REMARK *the Thirty fifth.*

The Learned Authour, p. 240. and 242. would prove this attraction in his supposed *tensed* and *rarefied* bodies in this sense, from the experiment of Cupping-glasses and the Bladder in the top of the Tube in the *Torricellian* experiment. But that these are no proofs for Attraction I have shewed * in former. *Remarks.* * Remark 30.

REMARK *the Thirty sixth.*

He here mentions again, p. 242. l. 12. the heated Tube we have spoke of, *Remark* 24. of its attraction and suspension of the water in it, the water in the Tube

Tube and the Tube weighing as one body; and the like experiment he makes here again of a heated Beer-glass with a more flew mouth, drawing up water, and weighing as one body with the water, he attributing the suspension of the water in both to the *attraction* of the rarefied Air. But that Hypothesis being so fully confuted by me, I am more solicitous in these instances to give an handsom account of the jointly weighing of the Tube and Mercury, of the Tube and Water, and of the Glass and Water, each of them as one joint body, than of confuting what is already confuted. And the case I conceive stands thus: By the *Hylostatick* laws of the *Universe* it is, that heavy bodies will even press upwards, as light upon heavy, and jointly both against a far lighter, though there be an heavy body betwixt, which

which I a little * above noted in the resiliency of the Quick-silver against the top of the Tube. Now as there the Air and restag-
nant Quick-silver gravitated against the subtil matter in the top of the Tube through the column of Quick-silver in the Tube, so the Air and Water gravitate both in the Tube and Drinking-glass, against the rarefied Air therein, it being thinner than the common Air, and ascended in each so far according to *Hydrostatick* laws; As I doubt not but that if a whole Tube of such subtil matter as is at the top in the *Torricellian* experiment could be had and were inverted into restag-
nant Mercury, the Mercury would be seen to ascend to 29 inches in the Tube as the water is seen to ascend in the Beer-glass and Tube. In all which cases both the Mercury and Water ascend by a *Libration* which this
Authour

* Remark
32.

Authour calls a *Gravitation upwards*, and are held there by the same Law at such a gage, and not by *attraction* or *suspension*. But how then, will you say, does the Tube and Mercury, the Tube and Water, the Beer-glass and Water, weigh each of them together as one joint body? 'Tis a considerable Problem, but I answer, The same *Hylostatick Principle* that thus librates them, which is the *Spirit of Nature*, does also, but with a vincible and mutable union, unite them. For both motion and union is from Spirit, as I have showed in my *Enchiridium Metaphysicum*. And from hence it will be easily understood, how when with the hand, p. 247. l. 12. you lift up the Beer-glass towards the superficies of the restagnant water, the water included will arise with it much above the superficies of the external water. Which though
it

it be not by that monstrous *Elastic* pressure of the Air that some are for, yet it is by a *Gravitation* of the Air upon the water, and of the water upwards, and both of them jointly against the rarefied Air in the Concave of the Glasse. So little need is there of any *Tension*, but merely of this *Hylostatick* Libration.

REMARK *the Thirty seventh.*

The Learned Authour, p. 248. l. 16. speaks of the power and efficacy of the Laws of Nature, in colligating strictly parts of the most distantial Textures and Consistencies without the help of Vellicles, Hooks, or Grappers, or *Atomi hamata*, and p. 238. he says, and that very truly and eloquently, *That all the men in the world can never give any satisfactory Reason, why the motion of a Stone is downwards to the*

L
Earth

Earth more than to the Moon, but only Nature that is the principium motus & quietis, or rather the God of Nature, whose standing and statuminated Law Nature is, has so ordered it, and ordered it so in the best way for the use, beauty and accommodation of the Universe: Wherein he does plainly declare that the laws of Nature are not *mechanical*, which if they be not, they must be *vital*, and if they be *vital* Laws, what is the immediate Fountain next to God, and subject in which this life is, or this principium motus & quietis? Is it a substance distinct from matter, or is it an essential power or modification of matter it self? For every thing is either substance or modification of substance. If these Laws of Nature be an essential power, or modification of matter, matter is self-moving, and is also herself-orderer, even
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to the expression of all those curious footsteps of the Divine Wisdom in the Creation, which is most apertly against *Aristotle*, whom our Learned Authour has no mean respect for, and who expressly gives only *passivity* to matter, but derives *activity* from another Principle. This is his frequent doctrine. And then which is still worse, it confounds the nature of Body and Spirit, the *motive* and *unitive* power being immediately and originally in *Spirit*, but the *moveable* and *unitable* in matter. But if these *vital* Laws in Nature that conduce to the good of the Universe, be not essential to the matter and act from it, it remains there is a *Spirit of Nature* to which they are essential, which is the mover and moderatour of the matter, which wants no Vellicles, Hooks, or Grappers, to hold those parts of matter toge-

ther that are to be held, or while they are to be held together, nor Chissels to loose them, as the Laws of Nature shall require. This this Learned Authour seems to be assured a Spirit is capable of, by the union of his Soul and Body; and it is a wonder to me, being we consist of those two Principles, that the Genius of the Age is so generally such, that they take all their measures of Philosophizing from their corporal part, none from their Spiritual, as if they had forgot they had any such, or were utterly unacquainted with its faculties, or as if their entire personal compositions were nothing else but a certain modified mass of Philosophizing matter: But that mere matter should so peremptorily hold together without those *Atomibamate* the *Epicureans* talk of, would be to me a greater wonder than that *they* should with them;

them; but that there remains the same wonder still how the parts of the *Atomi hamata* hold together, for Physical parts they must have, or else they could have no figure.

Upon Chapter the Seventeenth.

REMARK *the Thirty eighth.*

OUR Learned Author, p. 251. l. 12. resolves the close sticking together of two smoothed Marbles, with a weight hung at the lowermost, into *Fuga vacui*, for as much as if there should be a parallel divulsion of them, there would be some time, (motion not being in an instant,) before the interiour distance could be supplied with matter. Which therefore would cause a *Vacuum* in Nature. Which no question Nature does abhor from, and which might be without any

Cap. 6:

Logical Repugnancy, (there being so plainly an *Extensum* every where distinct from matter, as I have abundantly demonstrated in my *Enchiridium Metaphysicum*) did not the Laws of Nature oppose it. But we must note also that *Fuga vacui* is but the *final* Cause, but those that slight this solution, seek after an *efficient* Cause; and here again we must either make matter self-moving and self-uniting, or self-fixing, or else we must have recourse to the *Spirit of Nature* and its *Hylstatick* Laws, whereby it governs the matter; and whereby indeed it holds the whole compages of the world together. For the world being finite, as I have proved in my *Enchiridium Metaphysicum*, and consisting of an indefinite number of *vortices* and what ever other liquid matter, if the motion of the matter were *mechanical*, and not from a *vital*

Cap. 10.
Sect. 6.

vital Principle actuating it, which I call the *Spirit of Nature*, there would be a *dehiscency* of the parts of it, and nothing would be so plentiful as *vacuities*, when-as now there is either none at all, or as little as may be imagined. For the divulsion of the Marbles incliningly or angularly, will very hardly be conceived without some infinitely small vacuity, unless motion can be conceived to be in an instant.

REMARK *the Thirty ninth.*

Upon *Stevinus* his Experiment occurring here again, p. 259. l. 10. how that a Rundle of wood, lighter than water, laid upon the hole of the bottom of a Vessel to be filled with water, that the pillar of water on that wood will keep down the Rundle, and indeed will gravitate to the full weight of such a dimension of

L 4 water,

water, when-as, if that hole be not under the Rundle, it of it self will come up. I say, this were a great Paradox in Nature, if the parts of water gravitated on water, and that there were such a monstrous *elasticity* of the Air. For the recoiling column of Air bearing against the Rundle through the hole, of such a diameter, as that such a column would overcome in some other cases some hundred pounds weight, this should make the Rundle arise with far greater ease, than when the bottom of the Vessel is whole and is not perforated; therefore it is a plain indication that there is no such constant pressure of the parts of water on water, nor any such prodigious *elasticity* of the Air, but that the motion and rest of matter is *pro re nata*, according as the *Hylostatick* spirit of the world guides it. For certainly that upper *Elater* of the
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the Air that presses the water on the Rundle, is less resisted by far, by the bottom unperforated, which does not heave at the Rundle to lift it up, than it is by the column of Air below, that heaves so strongly as might match some hundred pound weights. Which consideration will be most unexceptionable if for a Rundle we place a lesser Vessel with thin sides, with four small holes made slopingly through the sides at the bottom, as I have above described upon another Occasion. It will be hard then to find any evasion if the inward Vessel ascend not as it does when the bottom is unperforated.

Upon

Upon Chapter the Eighteenth.

REMARK *the Fortieth.*

THat the divulsion of the *Magdeburg* Hemispheres, p. 267. is so far much easier side-way, than from their Center, I easily accord to; for in such a divulsion there is as it were the power added of a double wedge, but in pulling directly from their Centers, it comes nearer to the case of one attempting to pull a Billet into two, by taking hold of this side and that side of the middle of it, and so to part it into two, in a parallel separation of each part. But that they are held together by any such *Tension* of Filaments, or the *contraction* of them, while they adhere to the concave of the Hemispheres, seems not to me at all credible. For though the Learned Authour
argues

argues indeed shroudly against the *elasticity* of the Air being the cause of their adhesion, because, if the Hemispheres after they have grown cold adhere so close together, that the weight of 30 pound will not sever them, (by reason of the *elasticity* of the Air or weight of the Atmosphere pressing them together,) yet though they were put again into a considerable heat, they would adhere as strongly still, the *elatercy* of the Air being not at all diminished, but rather encreased by warmth, it exciting the spring thereof to a more forcible expansion, which therefore must press the harder against the Hemispheres; but that it is observed that if they be but made blood-warm they will easily fall asunder, which I confess is no contemptible argument against the *elasticity* of the Air's being the cause of this so strong cohesion:

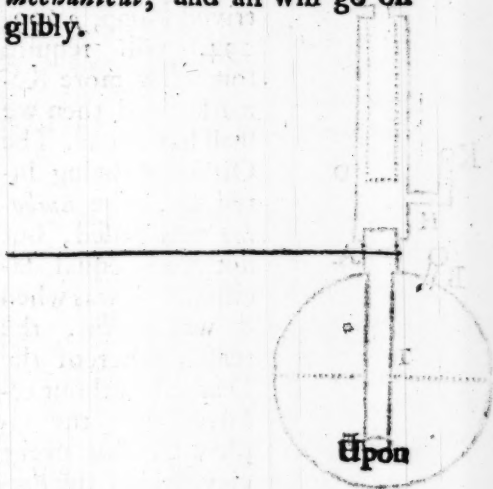
sion: Yet it is in my opinion one argument amongst others, that it is not the *contraction* or *restitution* of the *tensed* matter in the Hemispheres, that is the cause thereof. For if it were upon so strong a *stretch* and *contraction*, as he ordinarily expresses by the stretch of a Lute-string, it is incredible that so small a moment of heat should so suddenly and hugely relaxate it, that the Hemispheres should as it were fall asunder of themselves, that before stuck so strongly together that they bore 30 pound weight, which Relaxation neither can be without penetration of Dimensions, which immensly heightens the incredibility of it, that so small a force should cause penetration of Dimensions, as I have also observed * before in the *Torricellian* experiment, besides all other repugnancies that recurr here again. And therefore as the
 Learned

* Remark
 1. part 7,
 and 8.
 Remark
 33.

Learned Authour would conclude from the remotion of the *elasticity* of the Air, there none other appearing, that his *Tension* and *Restitution* must take place; so I by like reason, by the remotion of the *elasticity* of the Air and his *Tension* & *Restitution*, may infer that my *Hylostatick Spirit* of the world ought to take place, which acts *pro re nata* upon the matter, constringes and relaxes as occasion is. And here I say, upon cooling of the Hemispheres, here is a *gravitation* of the Air *inwards*, toward the common Center of the Hemispheres, by reason of the subtilty of the matter there contained in an undue place, and the sides of the Hemispheres are kned together, as a man may sometimes feel his Ribs to be in some subtil cold Air, and we feel this contraction not from within, but rather from without or in our very Ribs. I
say

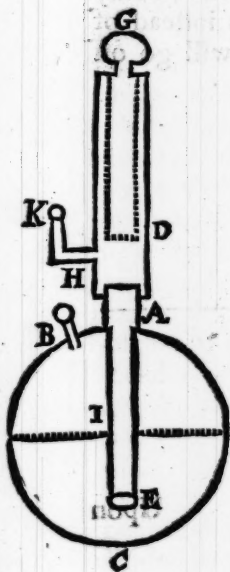
say therefore there is an *occasional* Gravitation of the ambient Air and Hemispheres themselves against the *rarefied* Air or subtil matter within them, to squeeze it out, as there is of water against a Bottle of Air let into the Sea, which sometime this very pressure breaks: Which cannot be expected in these brass Hemispheres; but this compression being not *mechanical* but *vital*, a little hint changes the operation, as in the board that ascends in a Bucket, if there be a hole in the bottom of the Bucket it will not ascend, but if there be a false bottom below that, at a due nearness, it will, and the *obturatorculum* of the Valve in the Tube that will adhere to the Valve, if the Tube be open into the Air, yet do but stop it with your *Embolus* at a right distance, the *obturatorculum* will descend. So a little warmth here makes the *Hystatich*

statick Spirit of the world quit
her compressive operation, and
relaxate her hold, without *pene-*
tration of Dimensions or any o-
ther absurd supposition; only
suppose *vital* motion instead of
mechanical, and all will go off
glibly.



Upon Chapter the Nineteenth.

REMARK the Forty first.



THE Author's ingeniously contrived Pump, p. 293, 294. will require some few more Remarks, and then we shall have done. The Orifice B being luted up, the *Embolus* was raised, but not with equal facility as it was when it was open, the reason whereof the Learned Authour resolves into the violent *Tension* every elevation of the *Embolus* gives to the Air in the upper Cavity of the Glass, that it may thereby

thereby be able to supply the place of the water drawn up by the Pump. But I conceive it is to be resolved into the strength of the *consistency* of the Air without, which without some violence will not suffer the *materia subtilis* to be squeezed out of it into the Cavity of the Glass. So that there wants no *Tension* for the making up this *Phanomenon*.

REMARK the Forty second.

The Glass-bottle A B C holding 5 quarts of water, and first freely by pumping being evacuated of $2\frac{1}{2}$, the Orifice at B after being luted close, a quart more with much ado was pumped out, so that there was but one and $\frac{1}{2}$ left, into which notwithstanding the Pipe of the Pump did reach. But after this, be the *Embolus* never so often lifted up, not a drop of

M water

water comes. But the Air only, says our Authour, included in the Pump is rarefied by lifting up the *Embolus*, and condensed by depressing it. Which very experiment methinks should be a sufficient confutation of this kind of *rarefaction* and *condensation*, as if one mans strength were able to cause so monstrous a thing as *Penetration of dimensions*, see *Remark 1. part 6, & 7.* Nor is the reason of no more water coming, because the Air is now *tended* to the utmost that such a strength of the pulling up the *Embolus* can extend it, but it is from the greater *firmness* or *obstency* of the external Air, whose strength is invigorated by the *Hylostatick spirit* of the world, against that unfit constitution of having already so much subtil matter misplaced; as in the *Magdeburg Hemispheres*: besides that it were against the *Hylostatick laws*,

laws, that so heavy a body as water should shoot up so high into so extreme thin a body as that subtil matter in the Glafs *, and that without any fresh Air succeeding thereinto, or extreme heat proceeding. And I do not question but that if the *Torricellian* experiment were made under water, the Quick-silver in the Tube would stand hugely much higher than it does now in the Air. And therefore that consideration may have also its weight in this Phænomenon. But it is apparent there is no need of any *Tension* in these Problems, there being subtil matter to supply its room. And yet for this subtil matter, if the motions of the parts of the Air were wholly mechanical and not vital, we can find no reason but that the force of the *Embolus*, that at first pumping overcame the consistence of the Air, should not overcome it

* See Remark 271

still, that Glassful of subtil matter being nothing to that Ocean of it in the Air. So evident every way is our Hypothesis of an *Hylarchick Principle*.

REMARK *the Forty third.*

Moreover the *Embolus* reaching near H, and being elevable near to the top of the Laton Syringe or Pump, the Air, if we can gather any thing from the figure of the Instrument and its proportions, is upon the elevation of the *Embolus* to its full height, stretched in the Pump so (when-as the *Tension* of the Air in the Cavity of the Glass occupies a space to what it did before, but in the proportion of 7 to 5.) as to occupy a space that is to its former at least as 5 to 1. which is a greater sign that there is no such *Tension*, (For if there were, the Air in the Cavity of
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the Glass that is but *tended* as 7 to 5. would receive more *Tension*, and so make the water ascend) than that in the Pump should be so overproportionately *tended*. And consequently that the water is not suspended in a Pump by *Tension*, nor made to ascend to such an height by that means, but by *Gravitation-upwards*, either upon an actual misplacement of the subtiler Element, or upon the imminent danger thereof, which would be if the water receded, therefore it goes up till such an height or measure, the Air and Water above the bottom of the Pump gravitating upwards, not being so much crowded by reason of impenetrability of matter, as conducted and vitally moved by the *Hylarchick Principle* in this *Gravitation-upwards*. The force whereof is according to the solidity of the Elements that thus

gravitate. And hence also may emerge a reason why in this case not one drop of water comes, upon the elevation of the *Embolus*, namely because the *Gravitation* of the rarefied Air in the Cavity of the Glass, added to the restagnant water above the Orifice of the Pipe, by reason of the tenuity of the one, and small quantity of the other, is too weak to raise or sustain a pillar of water in the Pipe, that would reach up into the Pump, and so no water comes.

REMARK *the Forty fourth.*

But now upon supposition that the Pump were longer, *p. 297. l. penult.* or that there were a strong external heat applied to the superiour Air in the Glass, if the water in that case would be as easily raised as at the first, as our Authour affirms; In the first

first way, it must be when the Pump is so long, that the space the subtil matter occupies there upon the pulling up the *Embolus*, is larger than that it occupies in the Glass, or the matter rather more subtile. And in the second the reason might be, that the application of this heat changes the vital energy, that is, that peremptory firmness and obstinency I spoke of before, into a more relaxate operation, as I noted in the *Magdeburg-Hemispheres*. But I am not certain that either way will find success. But certain I am, upon no account of *Tension* and *Restitution* it will be, if success answer expectation.

REMARK the Forty fifth.

The Learned Authour collects out of the experiments of his Pump, p. 298. l. 16. That the *Gravitation* or *pressure* of the

external Air is not the cause of raising the water in a Pump; and as touching that *springie Atmospheric* way, his collection I conceive is true, but I said above and here again repeat, That the raising of water, and the suspension of it in a Pump, is by a circular pressure and Gravitation of the Air and Water incumbent on the superficies of water that the bottom of the Pump is on, which jointly *gravitates upward* with the water ascending in the Pump, as I above declared the Air and Quick-silver *gravitates upward* in regard of that subtil Element in the top of the Tube, and here the Air and Water gravitate upwards, that there may be no bare subtil matter in the Pump, to the disorder of the Universe: which gravitation of Air and Quick-silver, and of Air and Water upwards, is not, as I said, by any crowding or gravitating part upon

upon part, but they are all carried by the *Hylostatick Spirit* of the world in this orderly way and to so good an end, that there may be no inconvenience by misplacing the Elements of the Universe, of which I hold the *materia subtilis* to be one.

REMARK the Forty sixth.

His collections also against the very *elasticity* of the Air from the said experiments are ingenious, but I cannot insist on them, I shall rather take notice of what occurs, p. 302. l. 6. where he supposes that the immision or insinuation of the Air into the Cavity of a Well (for there is the same reason as in the Glass-bottle, that is, as it were, the Well of his Pump) is the *effect* not the *cause* of the recession of the water. The scruple here is, whether it may not rightly be said,
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to be both. For in that circle of Air and Water that is made in the going of the Pump, the moving of the Air, that by the coming out of the water is carried either toward the Well or into it, as it is the *effect* of the waters coming out of the Well and Pump; so, it making part of the circle of Air and Water that gravitates even to the bottom of the Bucket in the Pump, where the hazard of an *hiatus*, and the baring of the subtil *element* is, is also a *cause*, I mean *instrumental cause*, (for the *principal efficient* is the *Hylostatick Spirit* of the world) of the getting the water out of the Pump, it being part of that material circle in motion, caused by that Principle that guides the matter.

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REMARK *the Forty seventh.*

The two arguments against the *elasticity* of the Air, which the Learned Authour concludes with, are, if they be well weighed, very considerable. The first is, that if the *elasticity* of the Air in a low roof'd Room, or a Glass Receiver, is able to sustain the Mercury in the Tube at the same height in the *Torricellian* experiment, that it is sustained in the free Air where there is the weight of the *Atmospherical Cylinder* superadded to the said *elasticity* of the Air, it is a sign that they are both but a mere conceit, and that the Mercury is suspended by the pressure of neither. I must confess I cannot imagine how those *elastick* Philosophers can evade the evidence of this argument, unless they hope to escape by saying, That the *elasticity*

elasticity of the Air being brought to its highest vigour or force the Atmospherical pressure can give it, so it be but kept at the same springiness and tightness by the Glass or the roof of the Room, the *elasticity* being the same still, the effect will be the same. This a man might phantasie at first sight, but if he more distinctly consider the matter, it will not satisfie: For let the force *elastick* of the Air in the Glass or Room caused by the pressure first of the Atmosphere be as 10, and this conserved entire in the Glass or Room which does not press against this *elastick* Air, but stands immoved, nor would the Atmosphere, if it were incumbent on this Air, add any thing more to the *elasticity* thereof, but it will still remain as 10, yet though it add nothing to the *elasticity* of the Air, seeing it has a pressure and protrusive force in it,

it, which the Roof and Glass have not, it will notwithstanding have its distinct force super-added to that 10 of the interjacent *elastick* Air, through which it will effectually act for the easier raising or suspending of the Quick-silver, and consequently will suspend at an higher pitch than the Air in a Room or Glass can do, there being a small convenient Valve that would let out the Air, but hinder any from coming in. There is a nicety in this business, but I doubt not but the truth will be found on our Learned Authour's side, and the urgency forward or progressive *conatus* of the *elastick* Air, will add something to the account.

And besides, as an Appendage to this Argument, if we compare portions of this *elastick* Air without regard to the Atmosphere, the least proportion of
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it will have equal effect with the greatest, and a Cylinder of *elastick* Air reaching from the roof of the Room to the restag-
nant quick-silver, shall have no more force for the sustaining of the Mercury in the Tube, than one of but the tenth part of an inch high, which is again a sign there is no such *elasticity* at all. For no man will say that the smallest charge of Gunpowder will, when it is fired, explode the Bullet with equal force, that a due quantity of Powder will; for all its *elasticity* or expansive-
ness is more quick and smart than this of the Air. Or that, if but a quarter of an inch of Air, or less, were condensed to that propor-
tion that a due measure of air in a Wind-Gun uses to be, that it will discharge with that force that the other does, and yet both their motions here are by *elasticity* properly so called. Where-
fore

fore there being these differences where *elasticity* is really, but none in the pretended *elasticity* of the Air, it is a sign it is a mere pretense and no true *Phænomenon* in Nature.

And now for the Authour's other Argument which he raised out of his Pump, which is this; If there were any such *elasticity* of the Air, suppose in a close Room or Glass that could keep up a Cylinder of Mercury, (I add, and raise it too, if a Tube of *Materia subtilis* only, could be let down into it) to 29 inches high, which yet according to the amplitude of its Diameter may weigh two, four, or ten pound, it were impossible but that the *elater*y of the air in his Pump (it being open at K and B, so that the Air may come in at B, and either Air or Water go out at K) should drive a portion of water into the Pipe of but half an inch diameter,

diameter, so that it may rise above the surface of the restagnant water in the Glas-bottle, suppose an inch or half an inch high, which is nothing in a manner to the raising of 10 pound weight. Which we shall understand still more clearly and convincingly, if we will suppose the Pipe of this Pump of such a diameter that 29 or 30 inches of Mercury in it would weigh 10 pound, and a Glas-bottle of a diameter 18 times larger than that of the Pipe, which is the proportion that this Glas-bottle does really bear to this Pipe in the Pump: Then imagine this Glas-bottle so well replenish'd with Quick-silver, that the restagnant Quick-silver will reach somewhat above the middle of the Glas, the Pipe in the mean time filled 29 or 30 inches full of it, it will stand at thereabout, though it be 10 pound weight; nay I dare appeal to any
considered

considered Philosopher if there were a Glass-Tube of 4 foot, or longer, of mere *materia subtilis* immitted into this Glass-bottle of Mercury, sufficiently replenish therewith, if he can otherwise think but that the Mercury will rise up to about 29 or 30 inches high. But for the sustaining of it, it is acknowledged of every side, that 10 pound weight of Mercury 29 inches high, is sustained, whatever it be that sustain it. The *elastick* Philosophers say, it is the *elater* of the Air in the Glass-bottle, which bears so strongly against the restagnant Mercury, that the 29 inches of Mercury, that weigh 10 pound weight, cannot descend into the restagnant Mercury. But our Learned Authour here most rationally denies it, averring, that if there were so strong an *elater* of the Air as to drive up or bear up 10 pound weight of Mercury,

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which

which is here 29 inches in the Pipe or Tube; certainly the same *elasticity* would drive or bear up one inch of water into the Pipe or Tube, it being many hundred times lighter than those 29 inches of Mercury. But here the *elastick* Philosophers seek a witty refuge, *viz.* That it is the Non-resistence of the *materia subtilis* that is destitute of all *elasticity*, which is the reason of the prevalency of the *elatercy* of the Air to mount up or sustain so great weight of Quick-silver, but there being Air in the Pipe of like *elasticity* with that in the Glass-bottle in this other case, that it is that that stops all such motion of the water upward. But this is to indulge to pretty phancies against palpable sense and all true reason. It is already acknowledged by these *elastick* Philosophers, that there is an *elatercy* of the Air in the Glass, that will at least sustain,

tain, if not raise up a ten pound weight. Now if there be not an *elater*y in the air of the Pipe so strong as might resist such a force, but exceedingly far weaker, if any at all, the water must rise or stand an inch high at least, neither which is done. But now you may feel with your fingers end how exceeding weak the *elater*y of just such a Cylinder of Air is, as is in the Pipe, if you make a Tube of the same diameter with that Pipe, and make an *Embolus* of some wood equiponderant, or at least not lighter than water, and so fit it to the Pipe that it may slip up and down with all ease imaginable, which it may do and be close enough if it be oiled. And this easie slipping up and down of it, might be an argument how weak the *elater*y of the Air is in it, but that they will straight answer that you move the *Embolus* so easily upward, be-

cause the recoiling *elater*y helps you; but does not the direct as much hinder me? But put your *Embolus* in the water, whose surface I suppose the upper end of the *Embolus* will lie even with, then put the Tube on the *Embolus*, and putting your hand into the water, with your finger move up the *Embolus*, which you shall find to move against the *elater*y of the air in the Tube, if there be any, with extreme ease; you will discern that the force of $\frac{1}{4}$ of a pound weight at most, will repel the air with its *elater*y. How then can it resist the force that will draw up or sustain forty times as much? Wherefore it is plain upon supposition that the *elasticity* of the Air is so strong that it will raise or sustain ten pound weight, that it will so forcibly press the water in the Glass-bottle into the Pipe, that by reason of the straitness thereof in
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comparison of that part of the Glass, that contains the water, it will send it packing through that Pipe as Air sent out through the nozel of a pair of Bellows, by him that presseth the Bellows with his hands. All the air of the Bellows is pressed at once, and the motion of that in the Bellows being much slower, that in the nozel comes out quick and smart, and so would the water through the Pipe be driven with a swifter force by reason of its straitness, and new air coming in at the Orifice B, it would never leave running out at K, till the water were exhausted as low as E, which we seeing not done, we see hereby, that there is no such *elasticity* in the Air at all, as our *Elastick* Philosophers suppose.

We will obviate the vanity of but one evasion more and then conclude. The pretense of the recoiling *elater*y of the Air we

took away by placing the little Tube and *Embolus* of wood in the water. Here perhaps they will say, that the Elatery of the Air on the surface of the water, causes the *Embolus* so easily to be pressed against the elatery of the Air that is incumbent on it. But how can that be, whenas the water has no elatery to lift up my hand, or bear against the bottom of the *Embolus*, and the water only succeeds the pressure of my finger against the *Embolus*, does not press with it, if we can believe our senses? so that there is merely a circle of such strength as the pressure of my finger makes and no more, And besides this, if this be any such advantage, the same is found in this Learned Authours Pump, the air coming in at B to make a circle of pressure by its elasticity to E and so to A and out at K, till it come to B again, and yet there

is not one inch of water raised by this elasticity above the surface I, though this elasticity is pretended to sustain 29 inches of Quick-silver of 10 pound weight. And that this mistake may still be laid more open, and no creep-holes left for further evasion, from the Valves or littleness of the passages at K and B, let us turn this round Glass into a large open Vessel, that the pressure of the air may come as free as heart can wish, and let into it a Tube, 29 inches whereof would contain 10 pound of Mercury, and which being immersed in Mercury, so many inches of Mercury would be suspended in: put upon such an *Embolus* as was above described, (whose upper Basis lies equal with the water) this empty Tube, and then put in your hand into the water, and believe your senses, with what ease that *Embolus* is to be pressed up against the ela-

tery of the air in the Tube, it requiring as I said before, scarce the force of a $\frac{1}{4}$ of a pound weight. Can therefore the *elater*y of the air sustain 40 times that weight, and keep the Mercury about 30 inches high in the same Tube, and not raise water into the Tube one inch high, which is above 400 times lighter than the 30 inches of Mercury it is pretended to sustain, whenas the *elater*y of air in the Tube is deprehended not to make the fortieth part of resistance against the *elater*y of air incumbent on the restagnant water, which is pretended to press forty times stronger? Wherefore the *elater*y of the air being so certainly deprehended not to do that which is forty times easier for it to do, it is impossible that it should do that which is forty times harder, and is a manifest demonstration there is no such *elater*y at all.

Conclusion.

Conclusion.

BUT now to bring all home at length to the intended scope, and to recount the chief fruits of our labour in making these *Remarks* on the Learned Authours two Treatises. If I be not out in my account, I conceive in my *Remarks* on the first Treatise (to say nothing of several in the second) I have clearly demonstrated the invalidity of all this Authour's inventions, though otherwise ingenious; whether *mechanical* or *natural*, (and yet such as would exclude the *Spirit of Nature*) whereby he might seem to undermine the strength of my Demonstration from the *rising of the wooden Rundle in a Bucket of water*, *Enchirid. Metaphys. c. 13. sect. 4.* Which demonstration therefore remains unshaken in the behalf of the *Principium Hylarchicum* or *Hylostatick Spirit of the Universe.*

Universe. And as for that other like notable demonstration, from the *ascending of so great a weight hung at the Embolus of the Air-pump*, the chief undermining of the force thereof being by either the *Elatery* of the *Elastick* Philosophers, or this Authour's *Tension*, the former this Learned Authour himself has so abundantly confuted with such plain and solid arguments, that any discerning person may easily discover the desperateness of that cause. And now for that other, I think I have offered abundant reasons for the incredibility, or rather impossibility thereof *. Wherefore the conceit of the *elasticity* of the Air, and of *Funiculus Lini*, or *Tension* in general being thus utterly defeated, it is manifest, the force of my Demonstration, *Enchirid. Metaphys. cap. 12. sect. 2, 3, 4, &c.* from the *weight at the Embolus of the Air-pump*, for the *Hylarchick Spirit* of the world holds

* See Remark 1. 29.
32, 33.

holds strong and entire still. And therefore I account, in a more distinct compute, that the fruits of my labour in making these *Remarks* are these. First, This Learned Authour I hope is freed from that anxiety & solicitude touching me, and is by this time satisfied that I have not incurred the guilt of that rashness and heedlessness as to make choice of *small* and *feeble* Arguments to sustain *great* and *concerning* Truths. For it is very judiciously said of him, and I am wholly of his mind, *That the most important and surest Truths in the world never receive so much detriment by Arguments and Sophistry of Opponents, as they do by those Arguments in their favour which have improper mediums to support their conclusions, or such as are capable of other solutions:* which I am very confident mine will never be found capable of. And I think from these *Remarks* this Learned Authour by
this

this time may be sensible, is no rashly grounded confidence.

Secondly, There is the redounding of no small commendation to this Authour for his industry and dexterity, and special sagacity in making and improving *Hydrostatical Experiments*, that are so considerable succours to such useful Truth. For he has very stoutly and pertinently assisted me in a more full defeating of that which always appeared to me an incredible Paradox, I mean that prodigious *elastick* pressure of the Air, and therefore I impute it to the modesty of this writer, that he has entitled his second Book *Difficiles Nugæ*. For though there may be some *difficulty* and *curiosity* in making and examining such like *Hydrostatical* experiments, yet believe me there is no *Nugality* at all, unless to those that make experiments for experiments sake, or to pass away the time, or to be thought great *natural* or rather *mechanical*

mechanical Philosophers, and that in hope to shew, that all the *Phænomena* of Nature may be performed without the present assistance or guidance of any *immaterial Principle*. But to try and consider these Experiments and *Phænomena* with that carefulness and distinctness, and penetrancy of discernment, as to discover there must of necessity be some *immaterial mover* underneath, there is no *nugacity* at all in this, but sound and serious *Philosophy*.

Thirdly therefore, This is no small fruit of this Authour's two *Treatises*, and of my labour in making my *Remarks* on them, that it does more plainly and evidently appear, that there is nothing of real strength can be said against my *Demonstrations* for the *Spirit of Nature*, but that of necessity there is such a Being in the world.

Fourthly, And that therefore it being so plain that there is this inferior immaterial Being endued
only

only with *life*, or some more obscure *sensation*, and that has the general strokes of the *Laws of the Universe*, but cannot act by *reason* and *counsel pro re nata*, it is manifest that there is a more noble and *divine Being* in the world that gave this inferiour *immaterial Being* its existence, and allotted to it in measure, or limited out to it those *general Laws of vital Activity*, which we discover in it in the *Phænomena* of Nature. Beside, that this certainty of the existence of the *Spirit of Nature* demolisheth the strongest Bulwark that ordinarily the Atheist has, namely his confidence that there is no such thing as a *Spirit* or *Immaterial Being* in the world. Whence he securely hugs himself in that fond and foul Conclusion, *That there is no God.*

Fifthly, Whenas many men are driven quite out of all conceit of ever understanding the nature of their own *Spirit* or *Soul*, by that sophistry

sophistry put upon them, that if it is a *Spirit* or Immaterial Being, it would pass through the body, but could not take hold of it or unite with it to move it; the discovery of the *Spirit of Nature*, moving as well as penetrating all the matter of the world, will as solidly and palpably confute the *Sophism*, as he did that against motion, by walking before the face of the Sophister that would prove there was none in the world.

Sixthly, Whenas this *Spirit of Nature* moves all the tenuious matter, and fluid as well as solid in the Universe, we easilier discern how rational it is, that *particular Spirits, Angels* suppose, or *Demons*, may have a faculty of moving their tenuious *vehicles*, and the *souls* of men the *animal spirits* in the body.

Seventhly & lastly, Whenas others according to the thickness of their conceptions cannot believe they have any soul at all, but take it for granted they have none, what a rousing argument ought this to be to them, to
awake

awake them out of this *dull dream*, to consider that a stone does not descend to the earth, but by the virtue of a *Spirit* that moves it downwards, nor a wooden Rundle ascend up in a Bucket of water, but by the same means? How then can it be possible, but that we being conscious to our selves of more *free* and *spontaneous* motions, of motions contrary to the tuggings of the *Spirit of Nature*, of motions *heavenly* and *divine*, that these can be performed by mere matter and body, and not by a particular Spirit really distinct therefrom? Wherefore there being that unexceptionable *evidence* for the *existence* of the *Spirit of Nature*, and that *egregious usefulness* of the knowledge thereof, I shall conclude for this ancient *Platonick*, or rather *Pythagorick* Opinion in this *Lucretian* strain of confidence.

Ergo etiam atq; etiam est in Mundo SPIRITUS ILLI
NATURÆ, qui Materiam regit atq; gubernat.

THE END.

